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Tar Distillation

IT may be true, as the Vice-President of the Association of Tar Distillers solemnly assured his guests at the annual dinner of that body, that tar distillation is a depressed branch of the chemical industry. It may be true—but those present did not fail to note the twinkle in the eye of the speaker, and the hilarity with which the *mot* was greeted by those who should have been most disturbed. Whatever may be the economic state of the tar industry, there is no doubt that technically it is in a very strong position. Within the last few weeks papers have been published upon various aspects of the tar industry that are of themselves adequate to prove this statement.

A very considerable proportion of the tar produced in this country is used as a road-making material, and for long there was a difficulty in that, whereas the coke oven or horizontal retort tars were satisfactory road-making bases, tars which contained a considerable proportion of aliphatic hydrocarbons were less suitable. A valuable series of researches has been published, first as a paper read before the London Section of the Society of Chemical Industry, by Mr. W. G. Adam and his co-workers, in which it was demonstrated beyond doubt that a suitable road-making material can be produced from vertical retort tar, provided that due attention is paid to their particular characteristics. These and similar studies elsewhere have extended the uses of tar, and not the least important feature of the researches just mentioned has been the light thrown upon the constitution of tar and in particular of soft pitch. What was known a few years ago as " free carbon "—that portion of the tar insoluble in benzene—has since been found to possess important properties and to be divisible, by extraction with pyridine, into two approximately equal proportions, one of which is at present believed to be a filler, and the other has been shown to possess important properties in that this constituent as obtained from a low-aromatic pitch is far more effective in conferring viscosity than the similar constituent from a high-aromatic pitch. For this reason the low-aromatic pitches require more oil, when " oiling-back " to road tars of equal viscosity, than do the high-aromatic pitches, and thus are more durable.

The " tar resins " (about 20 per cent. of the tar) which are insoluble in light petroleum but soluble in benzene, exhibit no apparent difference whether from high- or low-aromatic tars. Some 55 to 65 per cent. of tar consists of non-resinous material, soluble in benzene and light petroleum, and the unsulphonatable portion of this material seems to be responsible for much of the differences between high- and low-aromatic tars. An important process also has been developed recently whereby low-aromatic tars can be treated chemically to produce a quite remarkable material which appears likely to have important applications in road-making and for other uses. This material was referred to during the discussion upon the paper to which reference has just been made. It undoubtedly constitutes another fundamental advance in tar technique.

Yet another advance, this time in the technique of tar distillation, was described in the paper read last week by Mr. A. Grounds before the Coke Oven Managers' Association. It has always been recognised that tar distillation was comparatively crude, and that the separation of the fractions lagged some way behind that achieved in the petroleum industry. The tar distiller is now seeking sharp fractionation, greater throughputs per unit, continuous operation and decreased decomposition of the tar during the later stages of distillation. These objects can be secured by the new pipe still system, one form of which was described by Mr. Grounds. The tar is pumped under pressure through a battery of tubes arranged in a furnace in which it is first heated sufficiently for dehydration, and is then passed through a second set of tubes in which it is heated very rapidly to some 350° C., after which the pressure is released and the fractions vaporise. The vapours are successively condensed and dephlegmated, passing through the anthracene column to the succeeding wash oil, naphthalene oil, carbolic oil, and light oil columns in turn. Figures given in the paper show an extraordinarily sharp fractionation which it is stated " could never be approached by ordinary pot still distillation," and in addition a 5 per cent. greater yield of oil, with a very low heat consumption. This system, the Koppers pipe still, is in operation among other places at the Beckton works of the Gas Light & Coke Company, and it is claimed that this particular plant is the largest single unit tar distillation plant in the world. Another unit of equal size is being erected in Yorkshire.

Finally, there is a new development, recently announced by Sir David Milne-Watson, of a tar fraction that has been found to be especially potent for disinfestation of vermin-infested houses. The Medical Research Council has found that pure pseudo-cumene is of particular value for this work. It was known that this body is a constituent of the light oil, and attempts were made to prepare a fraction of high pseudo-cumene content. From these experiments it was ultimately discovered that standard high-flash naphtha would give the same satisfactory results. It is stated that the cost is considerably lower and the degree of safety is considerably higher than with the old methods.

Notes and Comments

Helium Supplies

IMMEDIATELY after the disaster to the German airship " Hindenburg " last year, a strong public feeling arose against the use of hydrogen in lighter-than-air aircraft. Recognising the strength of public opinion on the matter, America, which has practically a world monopoly of helium supplies, obtained incidentally from natural sources, announced that the ban placed hitherto on helium exports from that country would be lifted. But what was the result? As soon as Germany applied for a consignment of the gas for the new airship being constructed by the Zeppelin company, the ban was reimposed pending further consideration of the position. An announcement has now been made by the U.S. Secretary of the Interior that no helium will be sold to Germany unless she guarantees that the gas will not be used for military purposes. Apart from the fact that it is extremely unlikely that airships will ever be of use in war-time, it is ironical that Russia had no difficulty in purchasing (two days after the U.S. announcement) an American aircraft reported to be the deadliest air weapon ever built and described as a flying arsenal. The American statement can only be regarded, therefore, as a rather thin subterfuge and it is quite evident that as many difficulties as possible will be put in the way of obtaining the gas from America. Investigation of the technical and economic possibilities of extracting the gas from air is the remaining alternative if airship travel is to continue and develop in the future.

American Potash Industry

ACCORDING to advance figures issued by the U.S. Bureau of Mines, consumption of potash in the United States reached a new high record in 1937, with the plants of the leading producers working to capacity and an increase in imports of nearly 70 per cent. over the previous year. Exports were about the same in quantity as in 1936, although exports of compounds, other than fertilisers, diminished slightly. Imports rose to 352,300 short tons, in terms of K_2O, from 211,766 tons in 1936. Sales of domestic salts totalled about 270,000 tons, making the apparent new supply 622,000 tons or nearly half as much again as last year's total of about 435,000 tons. Data as to quantities in stocks are not known, but they are believed to have increased during the year. Taking this into account, actual consumption is still estimated to have increased substantially. There was a very marked increase, both in tonnage and value, of potash salts imported for use chiefly in fertilisers, and a slight increase in imports for use chiefly in chemical industries. Most of the imports were of materials originating in Germany; France, Chile, and Russia, however, furnished important quantities.

Replacing National Products

WHENEVER a synthetic material is produced which would appear to be a satisfactory substitute for a national product there is not unnaturally considerable cause for uneasiness on the part of those engaged in the preparation for sale and marketing of the natural product. The anxiety arising immediately on the introduction of the new synthetic is allayed, in nearly every case, when it is seen that the new material is not so much a replacement for the natural product but rather is an entirely novel addition to the range of particular materials available. No more striking example of this could probably be given than that provided by the textile industry. When artificial silk was first introduced in the early part of this century, the producers of natural silk were seriously alarmed. The conviction quickly grew, however, and is now universal that artificial silk was not a substitute for the natural fibre but was a unique product to which almost any required decorative effect could be imparted by dyeing and finishing. The fact remains that the synthetic fibre is fundamentally different from the natural in composition, structure, and properties. Much more recently a number of artificial wool materials have been introduced, outstanding among which is Lanital, made from casein. Although a somewhat similar sequence of events has taken place in this case, in the present stage of the technical development of Lanital its most useful outlet is in the production of wool-like materials from mixed fibres of Lanital and natural wool. So that in spite of the fact that Lanital cannot be regarded as a true wool, it is replacing wool to a certain extent for economic reasons. No doubt this will come under discussion at the conference to be held in June by the International Wool Textile Organisation.

A Useful Hydrogenation Catalyst

AN investigation of the hydrogenation of several organic compounds in the presence of finely-divided rhodium as catalyst, carried out by Zengheh's and Stathis (*Comptes Rendus*, 1938, 682-683), indicates the usefulness of the metal in this particular field. The quantity of rhodium employed was about 10 per cent. of the weight of the material treated and the catalyst was found to be for more active than any other precious metal, including platinum. Thus cinnamic acid was reduced to hydrocinnamic acid in 85 per cent. yield, and maleic acid was converted to succinnic acid to the extent of 82 per cent. Benzonitrile was almost quantitatively reduced to dibenzylamine, and the same was true of the conversion of acetone to isopropyl alcohol, and of benzene to cyclohexane. Nitrobenzene was reduced to aniline with a yield of 85 per cent.; aniline itself was completely degraded to cyclohexane and ammonia. In the reduction of azobenzene the compound was finally quantitatively converted to cyclohexane and ammonia. The unusual activity of the catalyst was especially well illustrated in the case of acetone, which is reduced in neutral solution at atmospheric pressure, whereas other catalysts require an acid solution and at least 2-3 atmospheres pressure.

University Research

THE extent to which the universities and industry should work together in matters relating to the work and future occupation of the student is a controversial topic. It goes, of course, without saying, that the university authorities should decide the student's courses of study, but in the matter of research work, especially in chemistry, industry can, and does, collaborate with the university with most satisfactory results to both. The pure research work undertaken by post-graduates is an indispensible contribution to scientific knowledge. Nevertheless, the financial aid granted by industrial companies to sponsor applied research serves the dual purpose of providing means for investigating a problem which may result in a discovery of direct practical application and of giving the student experience in working on problems of immediate interest to the company backing the research. The student who has had the opportunity of doing such research is usually more useful to industry.

Determining Olefines and Aromatics in Hydrocarbon Oils *

Optimum Conditions and Concentrations for Sulphuric Acid Extraction Methods

By
C. H. FISHER and A. EISNER

SULPHURIC acid of various concentrations has long been used as a reagent in the determination of olefines and aromatics in hydrocarbon oils such as gasoline, kerosene, and neutral oils from coal-tar distillates. Despite its long use, however, there is no general agreement as to optimum conditions and concentration of acid, and numerous methods and modifications have been recommended. In most cases, treatment of the neutral oil with 80 to 90 per cent. sulphuric acid, followed by distillation to the original endpoint to remove olefine polymers, is recommended for the estimation of unsaturated hydrocarbons. The distillate thus obtained is taken as olefine-free oil and used in later stages of the analysis. Aromatic hydrocarbons generally are determined in the olefine-free oil by suphonation with more concentrated acid (96 to 100 per cent. and fuming sulphuric acid are recommended), the hydrocarbons not attacked and removed as water-soluble sulphonic acids being considered as saturated hydrocarbons. In some cases the saturates are examined further by differentiating between cyclic (naphthene) and acyclic (paraffin) hydrocarbons. Generally this is achieved by physical methods, although strong sulphuric acid is known to react preferentially with some types of saturated hydrocarbons.

It was the purpose of the present work to make a general study of this type of analysis and to investigate the reactions of hydrocarbons under conditions often used in analyses that employ sulphuric acid reagents. Several sulphuric acid methods previously recommended and new modifications were compared, two synthetic solutions being used as the reference oil.

Determination of Olefines

It is well known (*J. Am. C.S., 40,* 825-856; *49,* 873--886) that, although the more reactive olefines react completely with 80 to 85 per cent. sulphuric acid, some of the olefines of higher molecular weight (cetene, for example) are hardly affected by acid of this strength. In the present work, a rather unreactive hydrocargon, diamylene, was used as a standard in the evaluation of various olefine reagents. The procedure used in comparing the several olefine reagents was as follows: 50 cc. of diamylene was shaken with 3 volumes of the acid reagent for 5 minutes at room temperature, and the layers were allowed to separate during half-an-hour. After the volume contraction was noted and traces of sulphuric acid were removed with anhydrous sodium carbonate, the upper layer was distilled through a short Vigreux column, the material boiling over 165° being considered as polymers.

It was found that either increasing the concentration of sulphuric acid or adding certain inorganic substances gives reagents of enhanced effectiveness. Silver sulphate was beneficial in all cases, and sulphuric-boric acid reagents (*Brennstoff-Chem., 8,* 353-358) were better than sulphuric acid alone. The presence of mercury, nickel, ferric, and copper salts was not helpful in the diamylene experiments. The ineffectiveness of many of the reagents, such as 80 to 85 per cent. sulphuric acid, in dissolving or polymerising the diamylene completely indicates that the many analytical methods employing dilute sulphuric acid give inaccurate results unless all the olefines present are rather reactive.

Several experiments were carried out to demonstrate the catalytic effect of silver sulphate and boric acid on olefines other than diamylene. The superiority of reagents containing silver sulphate was confirmed by these experiments, and the sulphuric-boric acid mixture, which contains about 80 per cent. sulphuric acid was found to be more effective than 80 per cent. sulphuric acid alone. The most effective olefine reagent, excluding concentrated solutions, appears to be sulphuric acid containing both silver sulphate and boric acid.

In view of the fact that Houghton and Bowman (*J. Inst. Petrol. Tech. 11,* 515-586), claim that maximum polymerisation is obtained with 91 per cent. sulphuric acid, it is interesting to note that 87.5 per cent. acid was more efficient than 95.5 per cent. acid in producing a high-boiling oil from diamylene. This result should not be interpreted as meaning that 95.5 per cent. acid is less reactive towards olefines.

Sulphonation with Olefine Reagents

It is obvious that sulphuric acid solutions used to determine olefines must not be concentrated enough to attack aromatic hydrocarbons. To determine the highest concentration of acid that can be used without sulphonating aromatics, the behaviour of both pure hydrocarbons and petroleum and coal-tar oils was studied. Toleune, xylene, and mesitylene were used as the pure hydrocarbons because of their well-known ease of sulphonation.

The aromatic hydrocarbons (20 c.c.) were shaken vigorously for 5 minutes at room temperature with 3 volumes of acid reagent in a graduated separatory funnel. No attempt was made to control temperature, which increased to about 35° when appreciable sulphonation occurred. The results of these experiments show that sulphuric acid of concentration higher than 84 per cent. cannot be used satisfactorily to determine olefines in the presence of aromatic hydrocarbons. The nature of the diluent has a marked effect on the sulphonating ability of the resulting solution.

Data obtained, however, indicate that, although reagents containing more than about 84 per cent. sulphuric acid are objectionable, a number of reagents are available which attack olefines energetically without sulphonating appreciable amounts of aromatics.

It has been shown (*Ber 23.* 3, 169-3, 174; *65*B, 1686-1689) that fairly concentrated sulphuric acid will cause olefines and aromatics to condense, the products being alkylated aromatic hydrocarbons. In a recent study (*J. Am. C.S. 58,* 919-922) carried out to determine the effect of acid concentration on reactions of this type, it was found that acid of low concentration caused the formation of alkyl sulphates. In the presence of more concentrated acid, the chief reaction was polymerisation of the olefine. Acid of still higher concentration caused condensation between olefines and aromatics. In the case of isobutene and benzene 96 per cent. acid caused chiefly alkylation, 80 per cent. acid caused polymerisation, and 70 per cent. acid converted isobutene into ester without polymerisation or alkylation. Propylene and benzene were found to condense in poor yield at 60° in the presence of 80 per cent. sulphuric acid. These experiments were not carried out under the conditions usually employed in the analysis of hydrocarbon oils and hence cannot be used with satisfaction to predict the behaviour of hydrocarbons in analytical procedures.

To find whether aromatics are alkylated under conditions often used in the determination of olefines, several synthetic solutions were shaken for 5 minutes at room temperature with three volumes of acid and then distilled through an efficient column (*Ind. Eng. Chem., 26,* 1213-1217) (10 mm. diameter

*From U.S. Bureau of Mines Report of Investigations.

and filled with glass spirals (*J. Am. C.S., 55,* 2795-2796) for a length of 20 cm.), usually with a reflux ratio of 12 to 1. The components of the synthetic oils had boiling points far enough apart to afford easy separation by distillation. The main purpose was to recover the unreacted aromatic quantitatively, and hence no effort was made to isolate and identify the alkylated aromatics and olefine polymers. Blank distillations indicated that this method could be used with confidence to recover unreacted aromatics.

Of the various olefine reagents studied, only 80 per cent. sulphuric acid failed to cause condensation between olefine and aromatic hydrocarbons. Eight synthetic solutions containing one or two olefines (cyclohexene, diamylene, amylene, d-limonene, pinene, octylene, and styrene) with one or two aromatics (benzene, toluene, and m-xylene) were used in these experiments, the aromatics being recovered quantitatively in all cases). Since acid of this concentration did not cause alkylation when reactive hydrocarbons (such as pinene, limonene, toluene, and m-xylene) were used, it is believed that from this standpoint 80 per cent sulphuric acid is a suitable olefine reagent.

It is apparent from the data that silver sulphate and boric acid in sulphuric acid solutions catalyse the alkylation of aromatics. It is believed that this observation has not been made previously. A comparison of the effectiveness of olefine reagents in causing sulphonation and alkylation of aromatics indicates that the latter reaction is more easily brought about. This points to the conclusion that alkylation rather than sulphonation is the chief cause of loss of aromatics during the determination of olefines.

Determination of Aromatics

A suitable sulphuric acid reagent for removing aromatics must sulphonate all aromatics present without attacking saturated hydrocarbons. In studying this phase of the sulphuric acid method of analysing oils, several representative aromatic, naphthenic, and paraffinic hydrocarbons were used.

Concentrated sulphuric acid (3 volumes of 95 to 96 per cent.) was found to sulphonate completely most of the aromatic hydrocarbons studied. A reagent (98 per cent. sulphuric acid) often recommended for the determination of aromatics was found to be a powerful sulphonating agent. The Kattwinkel sulphonating reagent (100 c.c. of concentrated sulphuric acid containg 30 g. of phosphorus pentoxide) was also found to be an efficient sulphonating agent, surpassing even 98 per cent. sulphuric acid in one instance. The addition of silver sulphate gave reagents of enhanced sulphonating strength. Phosphorous pentoxide also is capable of increasing the sulphonating action of sulphuric acid solutions, but this possibly is due to absorption of water rather than catalytic effect.

There is considerable disagreement concerning the stability of saturated hydrocarbons toward sulphonating reagents, but it is recognised that straight-chain paraffins are most resistant. As in previous experiments, 1 volume (20.0 c.c.) of the hydrocarbon was shaken vigorously for 5 minutes with 3 volumes of the acid reagent at room temperature. In most cases there was at least a slight reaction, which was indicated by loss in volume of the hydrocarbon, discoloration, and elevation of temperature. In general, the branched-chain hydrocarbons were most reactive.

The results show that the Kattwinkel solution and 100 per cent. sulphuric acid attack saturates too readily to be suitable as analytical reagents. It has been climed (*J.S.C.I., 38,* 39-43T) that saturated hydrocarbons are appreciably soluble in sulphonating mixtures, but in view of the fact that the large volume losses observed in the present work were accompanied by the generation of considerable heat it appears that chemical action is mainly responsible for loss of oil (*Ind. Eng. Chem., 15,* 587-591). If extraordinarily reactive hydrocarbons, such as isooctane, are excluded, the other reagents (95.5, 98 per cent. acid and 98 per cent. acid with silver sulphate) apparently give results as accurate as those obtained in the other stages of hydrocarbon oil analysis.

Two synthetic mixtures of known composition were analysed by several sulphuric acid methods previously recommmended and by four modifications of the Kester and Pohle method (*Ind. Eng. Chem., anal. ed., 3,* 294-297) that were expected to give results of greater accuracy. In order that the synthetic solutions employed in these analyses might resemble the complex neutral oils obtained from coal, several different representatives of each hydrocarbon group were included, and the aromatic contents were made high. The high olefine values obtained by the Morrell and Levine method (*Ind. Eng. Chem., anal. ed., 4,* 321-322) (olefines determined with 91 per cent. acid and distillation) indicate that the distillation residue was too great for substitution in their empirical formulæ. The large distillation residue probably was due to the presence of high-boiling alkylated aromatics. Petroleum distillates containing small amounts of aromatics might yield only negligible amounts of such condensation products when treated with 91 per cent. acid, but the formation of considerable amounts of alkylated aromatics is to be expected in aromatic-rich synthetic solutions and coal-tar oils.

Results of Analysis

Results indicate that aromatics were removed along with the olefines in the treatment with 93 per cent. sulphuric acid. This is not astonishing in view of the high aromatic contents of the synthetic solutions and the tendency of 93 per cent. acid to sulphonate aromatic hydrocarbons. The results obtained with the Kester and Pohle method indicate that their olefine reagent (80 per cent. acid) is satisfactory for neutral oils of the type derived from coal if only small quantities of unreactive olefines are present. With solutions containing appreciable amounts of unreactive olefines, it is probable that low olefines and high aromatic values would result. Since there is no evidence of the presence of large quantities of unreactive olefines in coal-tar oils (known to have high aromatic contents), the Kester and Pohle analysis is to be preferred to the other methods of this type that employ concentrations of sulphuric acid much over 80 per cent. as olefine reagents). The Ipatieff and Pines method (*Ind. Eng. Chem., 27,* 1364-1369), employing concentrated acid at 0° C. as the olefine reagent, gave such a high value for the olefine content that the analysis was not continued.

The other procedures used to analyse the two synthetic solutions were modifications of the Kester and Pohle method. Using 82 per cent. instead of 80 per cent. acid (modification A) gave results that were more satisfactory for solution 2, but less for solution 1. It was believed that using two reagents (80 and 82 per cent. acid) would be advantageous. Accordingly, 80 per cent. acid was used for reactive olefines (modification B), and the residual oil was treated with 82 per cent. acid to remove more unreactive olefines. This scheme gave values identical with those obtained by modification A.

Although all the modifications of the usual sulphuric acid analysis considered failed to give completely satisfactory analyses, a new method of the graphic type was found to indicate accurately the olefine and aromatic contents of both solutions. The graphic method is based on the changes in volume and physical constants that accompany successive extractions of the oil with sulphuric acid solutions of increasing concentration. (*Ind. Eng. Chem., anal. ed., 9,* 366-370).

Summary and Conclusions

In the determination of olefines, reagents such as 80 per cent. sulphuric acid, while quite effective with reactive olefines, fail to dissolve or polymerise the more unreactive olefines (diamylene, cetene, etc.). Sulphuric acid of higher concentration is more effective, but its use is limited because of its tendency to attack aromatics and catalyse the interaction of olefines and aromatics. Acid of concentration slightly higher than 80 per cent. may be used satisfactorily for oils of low aromatic content. Coal-tar oils containing large quantities of aromatic hydrocarbons require weak olefine reagents, such as 80 to 82 per cent acid. When 80 per cent. acid is used with oils containing unreactive ethylene hydrocarbons, low olefine and high aromatic values may be expected.

Previous claims that the addition of silver sulphate or boric acid to sulphuric acid gives olefine reagents of enhanced effectiveness have been confirmed. However, these inorganic substances cannot be used to advantage because other reactions of an undesirable nature are promoted. A moderately dilute sulphuric acid solution containing both silver sulphate and boric acid was found to be quite effective in dissolving and polymerising olefines, but not capable of sulphonating aromatics. However, this solution cannot be used to determine olefines, since it causes olefines to condense with aromatic hydrocarbons.

Sulphuric acid of concentrations up to about 84 per cent. may be employed with only negligible sulphonation of aromatics. However, acid of concentration as low as 82 per cent. was observed to cause the alkylation of aromatics. This demonstrates again that the greatest objection to using stronger olefine reagents is the interaction of olefines and aromatics.

Kattwinkel's olefine reagent (concentrated sulphuric acid containing boric acid) attacks olefines vigorously, but as it also sulphonates aromatics inaccurate results may attend its use.

Concentrated sulphuric acid was found to be quite effective in sulphonating 15 aromatic hydrocarbons. A sulphuric acid solution of higher concentration (98 per cent.) was observed to sulphonate aromatics with ease. Concentrations higher than 98 per cent. and Kattwinkel's aromatic reagent (96 per cent. acid containing phosphorous pentoxide) should not be used as reagents, since such solutions remove considerable amounts of saturated hydrocarbons. Silver sulphate may be added to increase the sulphonating action of aromatic reagents, but its use is not necessary or very advantageous. One washing with three volumes of either 96 or 98 per cent. acid was found to remove nearly all the aromatics from coal-tar oils. Two washings with about 3 volumes of 98 per cent. acid (or one washing with 96 per cent. acid followed by treatment with 98 per cent. acid) are recommended, since this procedure remove all aromatics without attacking more than traces of saturated hydrocarbons.

Using two synthetic solutions, several previously described sulphuric acid methods for determining olefines and aromatics were compared. Although no one method was completely satisfactory, the Kester and Pohle procedure (olefines determined with 80 per cent. acid gave the most accurate results.

Rancidity in Edible Fats

Methods Likely to Prove of Value for the Correction of Faults

AN account of the current state of knowledge concerning the development of rancidity in edible fats and fat-containing foods is given in a recently published special report of the Food Investigation Board (" Rancidity in Edible Fats," by C. H. Lea. Stationery Office, 3s. 6d.). Emphasis is laid chiefly on the more scientific aspects of the problem, but details of methods likely to prove of practical value in the diagnosis and correction of faults have also been included It has not been possible to answer satisfactorily many of the questions raised. Research in this branch of chemistry, however, is at present extremely active, and it is probable that further progress in the elucidation and control of the changes involved will be rapid.

The most important form of rancidity is that produced by the action of oxygen of the air on the fat. Decomposition by micro-organisms can only occur when the necessary moisture, nitrogenous substances and mineral salts are present, and within a comparatively narrow range of temperature. Atmospheric oxidation, however, occurs spontaneously when any material containing unsaturated fat is exposed to the air, though naturally the rate of change varies enormously with the type of fat and with the conditions of storage. Oxidative rancidity is of importance in soaps, textile oils, and other inedible fatty products. The formation of gummy exudations on the surface of leather dressed with oils and the drying of paints are also results of atmospheric oxidation.

Chemical Inhibitors of Oxidation

Moureau and Dufraisse investigated the effect of traces of foreign substances on the velocity of a great many autoxidative reactions. Their results, together with those of other workers, showed that the reaction between an autoxidisable substance and oxygen can be delayed for long periods by the presence of extremely minute quantities of foreign substances, variously termed inhibitors, antioxidants of antioxygens.

The action of such substances consists essentially in delaying the oxidation by the introduction of an initial lag or induction-period during which oxidation is very (sometimes immeasurably) slow. On the conclusion of the induction-period the rate of oxidation is usually identical with that of the substance in the absence of the inhibitor.

The fact that the oils present in ripening seeds and nuts, and in other plant and animal tissues exposed to air and light do not become rancid, points to the existence of some mechanism which protects them from oxidation, either by maintaining the concentration of oxygen in contact with the fat at an extremely low level, or by the formation of substances which inhibit oxidation. The first experimental indication of the presence of such inhibitors in certain oils appears to have been the observation that oxidative destruction of the fat-soluble vitamins A and (especially) E in experimental diets was greatly retarded when animal fats, such as lard and cod-liver oil, were replaced or supplemented by vegetable oils of equal or greater saturation. Subsequent work has demonstrated the association of these vitamins in a number of plant tissues with inhibitors which prolong the induction period of fats, and provides some support for the theory that the vitamins (and carotene) owe their survival in an environment otherwise favourable to oxidation to the protection afforded by antioxidants.

Further evidence has been provided by the observation that the glycerides resynthesised from the constituent fatty acids (after distillation) of several natural oils are very much less resistant to oxidation than the oils themselves, thereby suggesting that inhibiting substances are present in the original oils.

Destruction of the natural antioxidants during the ordinary processes of extraction and refining leads to a very pronounced reduction in potential resistance to oxidation, alkali bleaching agents and aeration at high temperatures being particularly destructive to natural inhibitors. Even boiling with " air-free " water effects a marked reduction in the potential keeping properties of some oils, at least 0.03 per cent. of hydroquinone being necessary to restore the induction-period of olive-oil to its original value after this treatment.

In only a few cases have pure substances possessing antioxidant properties been isolated from fats or fat-containing tissues. From the unsaponifiable fraction of the lipides of lettuce, Olcovitch and Mattill separated a crystalline product which possessed an antioxidant activity (which it lost on acetylation) comparable to that of α-naphthol, a fairly powerful antioxidant, and appeared to contain one or more phenolic groups. Olcott and Mattill have described the preparation of antioxidant-active concentrates from the unsaponifiable fractions of wheat-germ, cottonseed and palm oils. For the active constituents of these concentrates they propose the name " inhibitols," in order to indicate their function as inhibitors, and also the invariable occurrence of hydroxyl

groups, upon which their activity is considered to depend. Similar substances are said to be present in corn, sesame, soya-bean and arachis oils, and probably in many other vegetable substances, but are almost entirely absent from yeast, lard, olive, cod-liver, palm-kernel and castor oils.

As obtained from various sources, inhibitol concentrates are light yellow oils of medium viscosity which do not crystallise on long standing, and are stable under ordinary conditions in the laboratory for years. They are destroyed by reagents which attack hydroxyl groups, but in the case of the formation of esters, activity is largely regenerated on hydrolysis. Inhibitols appear to contain at least one double bond, since on reaction with halogens they lose their activity, regaining it on reduction with zinc-dust and acid. They are, however, resistant to hydrogenation, which diminishes, but fails to destroy their unsaturation.

Three Groups of Inhibitors

Inhibitol concentrates proved to be effective anti-oxidants for animal fats and for purified (distilled) fatty acids and esters, but they consistently failed to show any antioxygenic activity when added, even in relatively large amounts, to vegetable oil.

The reactions of the vegetable oils and crude esters provide a marked contrast to those of lard, esters of lard, and purified (distilled) fatty acids and esters, in which the acid inhibitors are all inactive or only very slightly active, and the phenols and the inhibitols very efficient. From these data it was concluded that the inhibitol originally present in the vegetable oil, and remaining largely in the residue when the crude esters are distilled, is responsible for the increased effect of the acid type inhibitors in the crude esters.

The inhibitors studied were divided tentatively into three groups:—(1) the acid type, (2) inhibitols and hydroquinone, and (3) the phenolic type, including α-naphthol, pyrogallol, catechol and others. Vegetable oils and crude esters of vegetable oils are protected by types (e) and (3) but *not* by (2) distilled esters of vegetable oils, lard and esters of lard, and distilled fatty acids and esters are protected by types (2) and (3), but *not* by (1). It was shown that in general any type (1) inhibitor, used in conjunction with any type (2) or type (3) compound, prolongs the induction-period of animal fats and of pure esters to a much greater extent than would be expected from a summation of the effects of each used alone.

Since it was first shown that corn and wheat-germ oils, or their unsaponifiable fractions, could be used to improve the resistance to oxidation of less stable fats, various means of utilising the natural inhibitors present in crude oils and in vegetable tissues have been suggested. Patents have been taken out, for example, to cover the addition of 5-10 per cent. of sesame-oil (hydrogenated to a suitable consistency) to lard, beef-fat and shortening fats, and of crude cottonseed-oil to refined cottonseed-oil or to lard.

Early Work on Stabilisation of Fats

The empirical use of various substances for the stabilisation of fats dates back many years. Deschamps' discovery (1843) that gum benzoin improves the keeping properties of lard has since been widely utilised in the preservation of this fat for pharmaceutical purposes. Chevreul (1856) was familiar with the fact that oak and certain other woods delay the drying of linseed-oil, and American Indians are said to have used the bark of trees for retarding the development of rancidity in bear-grease. These are both somewhat indirect methods of incorporating phenolic antioxidants in the fat. The work of Moureau and Dufraisse showed that many substances are capable of retarding the atmospheric oxidation of fats, certain phenols and organic nitrogenous substances being particularly effective. Much of the subsequent work on the stabilisation of fats has been carried out with substances of these types.

Attempts at the correlation of antioxident properties with molecular structure have led, in the case of the phenols to the elucidation of certain basic principles which appear to determine activity. Moureau and Dufraisse, in their original studies on the autoxidation of acrolein, showed that catechol, hydroquinone (quinol) and pyrogallol were much more powerful antioxidants than phenol and resorcinol, and these conclusions have since been confirmed and extended.

General conclusions arising from investigations upon phenols show that monohydroxybenzene (phenol) is practically inert, but the substitution of suitable groups increases its activity. Thus the o- and p-cresols and nitrophenols, thymol (2-isopropyl-5-methylphenol) and eugenol are all active. The introduction of a second hydroxyl group in the ortho (catechol) or para (hydroquinone) position enormously increases activity, while the substitution of a third hydroxyl to form pyrogallol (1, 2, 3) or hydroxyhydroquinone (1, 2, 4) still further enhances the effect. Activity now appears to have reached a maximum, tetrahydroxybenzene (1, 2, 3, 4) being only half as powerful as the 1, 2 and 1, 4 diphenols, and hexahydroxybenzene a completely inactive substance. The meta compounds resorcinol (1, 3) and phloroglucinol (1, 3, 5) are only very feeble inhibitors.

Structure Necessary for Antioxidant Activity

It appears to be necessary for antioxidant activity that the hydroxyl groups be directly substituted in an aromatic nucleus. Hydroxylated hexamethylene rings, for example, are inert, as are substances such as phenol-o- and p-carboxylic acids, and o-hydroxybenzyl alcohol, in which the second hydroxyl group is in a side chain. The hydrogen atoms of the phenolic groups must also be free. Thus, esterification of one or both of the hydroxyl groups of hydroquinone destroys its activity, while alkylation of one group greatly reduces, and of both completely destroys activity. Of the naphthols, the α-compound is a powerful antioxidant, the β-weak 1, 8-dihydroxynaphthalene is fairly active, the 1, 3 compound less so and the 1, 4 inactive. A number of more complex phenolic substances have been patented for use as antioxidants in fats and soaps, e.g., p-hydroxydiphenyl, p-hydroxy-diphenylmethane, and p-hydroxydiphenylether.

The second main group of substances which function as inhibitors of the oxidation of fats comprises the aromatic amino compounds. Aniline, like phenol, is only a feeble antioxidant, but a number of the substituted amines, particulary secondary compounds such as phenyl-α-naphthylamine and diphenyl-p-phenylene-diamine, are very active, as are certain amine-aldehyde condensation products (aldol-α-naphthylamine) and amino-phenols, diphenylhydrazine and diphenylguanidine. Substances of these general types are used in a wide variety and on a very large scale for the stabilisation of rubber; a number of them have been shown to be effective inhibitors of the oxidation of fats, but cannot be used in edible products.

Effect of Presence of Moisture

Several investigators have pointed out that substances such as the simple polyhydric phenols and amines, which are powerful antioxidants for dry fats, lose their activity when the fat is treated with water, particularly at a slightly alkaline *p*H, or when mixed and heated with any material comtaining moisture and protein. Thus, the addition of 0.05-0.1 per cent. of pyrogallol to fresh lard will preserve it almost indefinitely under ordinary conditions of storage, but the stabilised fat when made up into pastry or biscuits will not remain sweet for an appreciably longer period than the untreated lard.

Attempts have recently been made to overcome these difficulties by the use of substances insoluble in water but soluble in fat, such as can be obtained by the substitution of the simple polyhydric phenols or amino phenols. Examples claimed in patents are the pyrogallol-stearic acid compound $C_6H_2(OH)_3.CO.C_{17}H_{35}$, pyrogallol-dimethyl ether $OH.C_6H_3(OMe)_2$, the 1, 4 and 1, 5 dihydroxynaphthalenes $C_{10}H_6(OH)_2$, and the product obtained by the condensation of acetone with pyrogallol. Such substances are said to be odourless, tasteless, non-toxic and effective in the presence of water, but no data have been published concerning their activity or toxicity.

Substances such as the polyphenols and amines described above are undoubtedly toxic when ingested in quantity, though it is doubtful whether in the small amounts required they would be any more harmful than some of the natural constituents of foods. During the last few years increasing numbers of attempts have been made to utilise as antioxidants substances of undoubtedly non-toxic character. Of these carotene and lecithin, which occur naturally in association with fats, are of particular interest, but the evidence regarding their effect on oxidation has been conflicting.

Stabilisation of Fats by Hydrogenation

The external factors of temperature, light, and the presence of chemical accelerators and inhibitors are capable of controlling the rate of oxidative deterioration of fats over a very wide range. The chemical structure of the fat itself, nevertheless, remains a factor of considerable importance. In general, the more highly unsaturated a fatty acid or glyceride, the more rapidly will it tend to oxidise on exposure to the air. Coconut-oil, for example, which has an iodine-value of 9 and contains practically no acids with more than one double-bond, is enormously more resistant to atmospheric oxidation than a fish-oil of iodine-value 200, which contains a high proportion of acids with from two to six double bonds in the molecule.

Since the first industrial application (1902) of Sabatier's discovery that liquid, unsaturated fatty acids can be converted into the corresponding solid, saturated acids by treatment with hydrogen in the presence of a nickel catalyst, the practice of hydrogenating fats has attained the magnitude of a large industry. Enormous quantities of whale- and fish-oils, cottonseed, soya-bean, arachis and other vegetable oils are annually converted into solid fats, in which form they find use in margarine, cooking fats, pastry shortenings, soaps and candles. Naturally, in destroying the highly unsaturated acids of the liquid oils, stability towards oxidation is greatly increased, particularly as part at least of the natural anti-oxidant of the original oil seems to survive the treatment. A vegetable shortening prepared by partial hydrogenation of cottonseed-oil possesses fairly similar physical properties to lard, but is considerably more resistant to oxidation than either the animal fat or the original vegetable oil.

By slight hydrogenation it is possible to increase the stability of solid fats without greatly changing their physical properties. Lard, butter-fat, palm-oil and cacao-butter, for example, consist mainly of glycerides of saturated and of oleic acids, but contains in addition relatively small proportions of linoleic, and even traces of more highly unsaturated acids. Oleic, almost equally with the highly unsaturated acids, tends to produce a liquid fat, but is much less susceptible to oxidation. It follows, therefore, that if acids containing two or more double bonds can be made to combine with sufficient hydrogen to bring about their conversion to oleic acid, the physical characteristics of the fat will not be greatly altered, but its keeping properties will be considerably improved.

Improving Low Grade Lard

Only an approximation to this ideal can be obtained in practice. A mixture of esters or glycerides of oleic and linoleic acids can be hydrogenated so that a large proportion of the linoleic is converted to monoethylenic acid before any considerable amount of stearic acid is produced. The monoethylenic acid, however, consists of a mixture of ordinary, liquid oleic acid with solid (*iso*oleic) isomers. Data obtained for lard shows that slight hydrogenation which reduced the total unsaturated (liquid) acids by only 1.3 per cent., destroyed 74 per cent. of the linoleic acid originally present, while a decrease of 8.7 per cent. in the total unsaturated acids reduced the linoleic acid by 90 per cent. The greater susceptibility of linoleic acid to oxidation is shown by the relatively high rate at which it disappeared when the fat was heated in air.

Slight hydrogenation is useful in improving the quality of low-grade lard, and of oily lard produced by animals raised on softening feeds. Animal fats of low grade tend to possess an unpleasant flavour and a high free acidity, the latter reducing the smoking temperature of the fat and thus causing trouble in frying. The resistance to oxidative rancidity of fats of both types is low, and excessive softness in lard is a disadvantage when it is used as shortening. A combined process of deodorisation, neutralisation and slight hydrogenation converts these products into materials of better grade and improved keeping quality. It is said to be becoming common practice in the chocolate industry to reduce the iodine-value of cacao-butter by one or two points in order to reduce the tendency to "blooming" in the finished chocolate.

The following table shows figures for the selective hydrogenation of linoleic to oleic glycerides in cottonseed oil:—

Iodine-value of oil	Component acids (%)			
	Oleic	Linoleic	Total unsaturated	Total saturated
109.1	23.8	51.5	75.3	24.7
100.8	34.5	40.5	75.0	25.0
96.1	40.5	34.5	75.0	25.0
77.4	60.0	15.0	75.0	25.0
72.1	62.0	11.0	73.0	27.0
65.2	68.5	3.5	72.0	28.0
57.5	67.0	0.0	67.0	33.0

These figures show very clearly the selective nature of the process. They refer to the "batch" and to the "overflow" (continuous) processes, in which the vessel containing the catalyst is maintained practically full of oil in rapid motion. In the "drip" modification of the continuous process, in which the oil is allowed to percolate in relatively thin films over the catalyst in an atmosphere of hydrogen, hydrogenation is much less selective, and the proportion of stearic glycerides present increases steadily from the commencement of the run. The formation of *iso*oleic glycerides is, however, considerably reduced. Recent work indicates that selective hydrogenation is not universal, even with the "batch" process. Thus, the complex, highly unsaturated glycerides of whale-oil are said to be converted on hydrogenation first to the diethenoid stage, and thence directly to saturated acids. Further, in the case of rape-oil, which contains 50 per cent. of erucic ($C_{22}H_{42}O_2$), 30 per cent. of linoleic and 15 per cent. of oleic acid, hydrogenation appears to be much less selective than in oils in which oleic and linoleic are the chief unsaturated acids.

A Continuous Process

In the original or "batch" process of hydrogenation the oil is agitated with the required amount of gas under pressure, usually at a temperature of about 180° C., in the presence of a relatively small quantity of a highly active, finely divided catalyst. The latter is produced in this case by the deposition of nickel carbonate on a supporting material (kieselguhr), followed by careful reduction in a stream of hydrogen at 300°-350° C. The process, including the heating and cooling of the oil, filtration, etc., requires several hours for completion.

More recently a continuous process has been introduced. The catalyst in this case consists of nickel gauze or turnings, the surface of which is activated by anodic oxidation and subsequent reduction in a stream of hydrogen. The oil and hydrogen pass over the catalyst contained in a series of cylinders, the degree of hydrogenation being controlled by adjustment of the rate of flow. When only a slight degree of hardening is required, the output can be high. Filtration is not necessary, and the catalyst, which lasts well, can readily be reactivated.

The quantity of gas required for hydrogenation is small; 0.68 per cent. by weight, for example, will convert liquid triolein into tristearin, a hard solid which melts at approximately 71° C. Alternatively, 34 cu. ft. of hydrogen are required to reduce the iodine-value of one ton of oil by one unit.

EXPERIMENTS on peat-gasification are in progress at the All-Union Institute for Gases and Synthetic Liquid Fuels. An experimental generator at the Moscow Gas Works has a throughput of 30 tons of peat and the gas formed has a thermal value of 1,300 calories.

British Association of Chemists

Annual Meeting of the Manchester Section—Election of Officers and Committee

THE annual meeting of the Manchester Section of the British Association of Chemists was held on March 23, at the Engineers' Club, Albert Square. Mr. W. Kay, presenting the secretary's annual report, stated that the section had gained six new members during the year, but the rate of increase, in his opinion, was not satisfactory. Five meetings had been held, namely, a joint meeting with the Liverpool section at Chester, a lecture on air raid precautions by Col. Garforth, the smoking concert, and the annual meeting and dinner. The air raid precautions' lecture had attracted a large attendance, and members had expressed a desire for a further paper dealing with the more scientific aspects of A.R.P. The conversazione was as successful as its predecessor, and now appeared to be a well-established function. The hon. treasurer's report, presented by Mr. Pickup, showed a slight credit in the year's working.

The following officers and committee were elected:—Chairman, Mr. J. H. Dent; hon. secretary, Mr. W. Kay; hon. treasurer, Dr. R. G. Bartlett; committee, Messrs. J. Anderson, R. Brightman, P. Chorley, E. L. Dawson, J. L. Hankey, A. Hill, M. E. D. Jarrett, J. Keaton, J. Maddocks, H. E. Newton, L. W. Pickup, J. R. S. Waring, E. Walters, F. Page-Evans, W. M. Coates. The chairman referred to the valuable service which had been rendered by the retiring members, Mr. L. Pickup and Mr. T. Horner, and the meeting closed with a vote of thanks to the officers and committee, proposed by Mr. A. Gill, and supported by Mr. Scholefield, who said that the Manchester Section had been particularly fortunate in having members who were able and willing to give their time to furthering the work of the section and of the association.

At the dinner which followed, the guests included the President of the Association, Dr. J. Vargas Eyre, the chairman of council, Mr. A. J. C. Cosbie, and the general secretary, Mr. C. B. Woodley, together with Mr. C. M. Whittaker representing the Manchester Section of the S.C.I. and (in the unavoidable absence of Mr. C. J. T. Cronshaw) Mr. Scholefield, representing the Manchester Section of the Institute of Chemistry. Mr. Cosbie, proposing the toast of "The Association," referred to the work of the Unemployment Special Purposes Committee and of the appointments service. In the course of his remarks he said that 3,389 appointments had been circulated to members in the past eighteen months. Direct approach had increased by 70 per cent. The Unemployment Benefit Fund was in a strong position and present disbursements were low. Replying to the toast, Dr. Vargas Eyre appealed for a greater measure of co-operation between the various societies. Such co-operation, in his opinion, would have to start in the provinces—London might follow, but would not lead in this matter. Mr. Dent, who proposed the toast of "The Guests," stated that Manchester had an association of scientific societies of which the B.A.C. was not a member. Mr. Whittaker, replying for the guests, gave his opinion that membership of this association would be advantageous to the B.A.C.

Storage of Soyabean Meal

Changes Occurring in the Protein

CHANGES which may occur during the ageing of meal, affecting not only the chemical properties of the proteins, but also their nutritional value, present a problem of far-reaching importance. Studies have been started by Jones and Gersdorff (*J. Am. C. S.*, 1938, *60*, 723-4), to investigate the nature and extent of changes which occur in the proteins of seeds (both whole and ground) when stored under different conditions. Results thus far obtained show that marked changes in the chemical properties of the proteins of ground soyabeans occur very soon after grinding. Some of these changes suggest a decrease in the biological value of the proteins.

Two portions of freshly ground soyabeans were solvent-extracted. One portion was made practically fat-free, and the other to contain about 11 per cent. fat. Samples of both lots of the meal were stored in steel jars and in bags, in constant temperature rooms at 76 and 30° F. The samples were analysed at intervals of one, three, and six months, and the results compared with those obtained at the start on the freshly ground meal.

At the end of one month significant decreases in values had occurred in all the samples. On further storage the values continued to decrease. By the end of six months the digestibility of the protein of the low-fat meal stored in bags at 76° had dropped nearly 19 per cent. below that of the meal when freshly ground. The greatest changes occurred at 76°, although at 30° the changes were surprisingly high. Greater changes occurred in the meals stored in bags than in those stored in sealed jars. Of interest is the consistently greater changes that occurred in the low-fat samples than in the high-fat samples. The total nitrogen and free ammonia content of all the samples remained constant throughout the storage periods. The high-fat samples showed a slight increase in free fatty acids, particularly in the samples stored at 76°.

Storage of soyabean meal apparently results in partial denaturation of the proteins as indicated by their decreased solubility in salt solution. A proteolysis is also indicated by the drop in true protein values.

Chemical Matters in Parliament

Oil from Coal Output

ASKED in the House of Commons, on March 29, what was the approximate amount of light and heavy oil produced from British coal last year, Captain Crookshank, Secretary for Mines, stated that complete particulars of production were not yet available. With the exception of the information relating to hydrogenation, which has been supplied by the courtesy of Imperial Chemical Industries, Ltd., the following figures were estimates:—

Process	Refined motor spirit	Other refined light oils (Million gal.)	Heavy oils
Hydrogenation ...	35.0	—	—
High temperature carbonisation...	53.5	14.0	91.0*
Low temperature carbonisation...	1.0	—	6.0*

* Some proportion of these heavy oils (creosote and low temperature tar oils) are hydrogenated to obtain the quantity of motor spirit.

Ten Years Back

From "The Chemical Age," March 31, 1928

Unemployed insured persons at February 20, in Great Britain and Northern Ireland, in chemical manufacture, numbered 5,631 (males 4,830, females 801); in explosives manufacture, 1,092 (males 763, females 329); in paint, varnish, japan, red and white lead manufacture, 793 (males 642, females 151); and in oil, grease, glue, soap, ink, match, etc., manufacture, 4,668 (males 3,842, females 826).

* * * *

The customary notices to chemical manufacturers reminding them to renew certificates of registration have been enlarged to include several new processes, which are brought within the scope of the Alkali Works Act for the first time, chiefly concerning benzene, pyridine, bromine, and hydrofluoric acid.

The Chemical Age Lawn Tennis Tournament

Arrangements for 1938

PRELIMINARY arrangements have now been completed for the eighth annual CHEMICAL AGE Lawn Tennis Tournament. As in previous years, the tournament is open to all members, both principals and staff, of the chemical industry throughout Great Britain. It will consist of a men's singles and a men's doubles competition, and the matches will be played during May and the following summer months, the date of the finals being provisionally fixed for Saturday, September 3. The winners of both competitions will hold THE CHEMICAL AGE silver challenge cups, jointly with the firms they represent, for one year, while smaller trophies will be presented outright to each of the winners and the runners-up.

During the past year the singles cup has been held by Mr. R. M. O. Williams, of Imperial Chemical Industries, Ltd., and the doubles cup by Mr. G. W. Hole, of the Anglo-Saxon Petroleum Co., Ltd., and Mr. C. G. Smith, of Shell-Mex and B.P., Ltd.

The growing popularity of the tournament is evident from the increasing number of entries received each year, and this year we are hoping to make the tournament still more successful by an even larger entry. We are looking forward to seeing entries not only from last year's competitors, but from members of the industry who have not yet competed. An especially cordial invitation is extended to tennis players in the provinces, and it is hoped that they will make a special effort to participate, thus lending additional interest to the tournament. For the convenience of provincial entrants, plans are being made for all the early round draws to be arranged so that provincial players will meet each other as near home as possible in order to minimise the difficulties of travel.

Alterations to the Rules

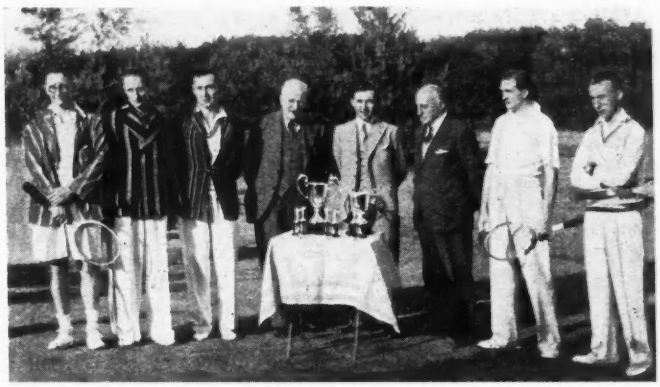
We are again pleased to have the co-operation of a small representative committee, which held its first meeting at Bouverie House on March 11, under the chairmanship of Mr. John Benn, a director of Benn Brothers, Ltd., proprietors of THE CHEMICAL AGE. The committee made two minor alterations to the rules. It was decided that the results in the semi-finals of both singles and doubles matches should be determined by the best of five sets, instead of the best of three sets as hitherto. Further, it was thought that the conditions of play in the semi-final rounds would be more fair to the competitors concerned if the matches in these rounds took place on a court mutually agreed upon by the competitors, the court being preferably neutral ground. The rules have now been amended accordingly.

All entries for the tournament must reach the Editor, THE CHEMICAL AGE, Bouverie House, Fleet Street, London, E.C.4, not later than first post on May 2. Entry forms can be obtained on application, either by telephone, letter or in person, from the Editor. Competitors are urged to secure and send them in as early as possible.

The rules governing the tournament are printed below. The draw will be made on May 2, and competitors will be notified at once as to the result of the draw and the final date for playing off the first round matches. There is no entrance fee, but it is understood that the players pay their own travelling expenses, etc.

PROVINCIAL ENTRIES

The organising committee feels that every encouragement should be given to entries from the provinces, the preliminary rounds being arranged by districts as far as possible. It is considered that additional interest will be attached to the tournament if there is an increased entry from the large provincial centres.



Before the presentation of the cups at last year's finals.

RULES OF THE TOURNAMENT

1. Every competitor must be a member of the chemical industry, either as a principal or a member of a staff. There is no entrance fee of any kind.

2. Players in the Doubles need not necessarily be members of the same or associated firms, provided all players are members of the chemical industry as defined in Rule 1.

3. The Challenge Cups, which shall not be awarded outright, irrespective of the number of times they are won by the same players, shall be competed for annually on courts of any surface in accordance with the Rules of Lawn Tennis and the Regulations of the Lawn Tennis Association. The winners of the Cups shall make arrangements for their safe custody and insurance.

4. The competition shall be conducted on the knock-out principle, and the best of three advantage sets shall be played in all matches, except in the semi-finals and finals when the best of five sets shall be played. At the discretion of the Editor of THE CHEMICAL AGE and the members of the tournament committee present at the finals, play may be restricted to the best of three sets should conditions make this necessary.

5. Entries shall be made not later than May 2, 1938 (first post), on forms which may be obtained on application to :

The Editor,
"The Chemical Age,"
Bouverie House,
Fleet Street, London, E.C.4.

6. The draw shall be made on the first convenient day following the close of entries. The dates on or within which the several rounds must be played will be published in THE CHEMICAL AGE.

7. The Editor of THE CHEMICAL AGE, acting with the tournament committee, shall have the right to scratch any players who fail to play off their matches by the stipulated dates, or who otherwise fail to conform with the rules and regulations governing this competition.

8. Except in the case of the semi-finals and finals, the first name drawn shall have the right to choose the ground. In the case of semi-final round matches, play shall take place on a court mutually agreed upon, which shall be a neutral ground if possible.

9. The result of each match must be sent by the winners to the Editor of THE CHEMICAL AGE, signed by all players (winners and losers), immediately after the match, and must reach the office of THE CHEMICAL AGE not later than by the first post on the day following the final day for playing off the round.

10. If any player be not present at the agreed place or time of the match, opponents shall be entitled to a walk-over, after having allowed reasonable time (say, a maximum of one hour) for the other's appearance. If the players find it impossible to play off their match on the day originally chosen, they must play it on any other day, to which both sides agree, within the stipulated period.

11. Any dispute arising between players, or otherwise, shall be referred to the arbitration of the Editor of THE CHEMICAL AGE, acting with the tournament committee, whose decision shall be final.

12. While competitors will decide as to hard or grass courts for the preliminary rounds, it must be understood that the Finals must be played on courts selected by the Editor of THE CHEMICAL AGE, acting with the tournament committee.

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Developments in natural resin technology. Skett and Allen, *Paint Oil Chem. Rev.*, *100*, No. 5, 7-8.

Causes of paint perishing. MacGregor, *Paint Varnish Prod. Manager*, *18*, 82-83, 106.

Paint primer technology. Robertson and Hoback, *Paint Varnish Prod. Manager*, *18*, 98-103.

Extraction of plasticisers from nitrocellulose lacquer films. *Farben Ztg.*, *43*, 307.

Rubber, Plastics

Synthetic resins from coal-tar hydrocarbons. Carmody, Sheehan and Kelly, *Ind. Eng. Chem.*, *30*, 245-251.

Polymerisation of methyl methacrylate in organic solvents. Strain, *Ind. Eng. Chem.*, *30*, 345-347.

Artificial resins as electrical insulators. Pallas, *Gelatine Leim Klebstoffe*, *6*, 17-21.

Resistance of artificial resin films to blows. Möller, Kölln and Scheiber, *Farbe u. Lack*, 1938, No. 8, 90-93.

Polymerisation of vinyl acetate. Meunier and Vaissière, *Compt. rend.*, *206*, 677-679.

Miscellaneous

Influence of *p*H on adsorption. Bruns, Berstein, Fedotow and Liwschwitz, *Acta Phisicochim.*, *8*, 47-62.

Adhesive pastes. Ohl, *Gelatine Leim Klebstoffe*, *6*, 3-6.

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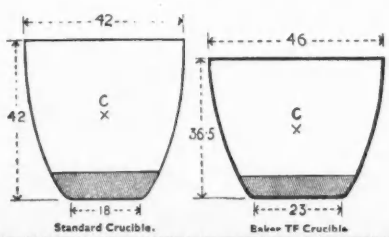

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Personal Notes

THE LATE MR. CHARLES POLLOCK, soap manufacturer, of Paisley, left estate valued at £8,652.

MR. P. H. SYMONS has been appointed assistant analyst in the Medical Department at Hong-Kong.

MR. G. R. HALL CAINE has resigned his position as a director of British Coated Board and Paper Mills, Ltd.

MR. J. SHELTON, chemist at the Institute for Medical Research, Malaya, has been promoted to the post of chief chemist.

THE LATE MR. ROBERT CROSS, of Gogar Park, Corstorphine, Edinburgh, chemical manufacturer, has left personal estate in Great Britain valued at £196,838.

PROFESSOR JACQUES ERRERA, of Brussels University, has been awarded the Emile Franqui prize of £3,500 for his works on the molecular constitution of matter.

THE LATE MR. ANTHONY VINCENT TARPEY, of Bury, Lancashire, colour merchant and drysalter, left estate of the gross value of £16,163, with net personalty £14,714.

THE LATE MR. HERBERT PERCY LITTON, of Plumpton, Bamford, Heywood, tanner and leather currier, managing director of Sylvester Little, Ltd., has left £88,300, with net personalty £82,537.

THE LATE MR. CUYLER WHITTLE FINDLAY, of Ealing, chairman and managing director of the Glacier Metal Co., Ltd., has left estate valued at £348,563, with net personalty £336,934.

DR. F. R. WINTON, M.D., B.Ch., M.A.(Camb.), has been appointed to the University Chair of Pharmacology tenable at University College, as from October next. Since 1933 he has been reader in physiology in the University of Cambridge. bridge.

PROFESSOR W. J. DILLING has been nominated to serve as a member of the Council of the Pharmaceutical Society in succession to Professor J. A. Gunn, one of the retiring members. Professor W. J. Dilling is professor of pharmacology and general therapeutics at Liverpool University.

VISCOUNT LEVERHULME, governor of Lever Bros., Ltd., planted a tree at Port Sunlight to mark his 50th birthday on March 25. He used the silver spade with which his mother, three weeks before he was born, cut the first sod to begin the building of Port Sunlight. He was accompanied by Viscountess Leverhulme, the Hon. Philip Lever and Mr. R. E. Huffan. The Hon. Philip Lever planted a second tree to mark the jubilee of the cutting of the first sod by his grandmother.

DR. ABRAHAM WHITE, assistant professor of physiological chemistry at Yale University, has been chosen by a committee of the American Chemical Society to receive the $1,000 Eli Lilly and Co. award in biological chemistry for 1938. The honour goes to Dr. White for his work on sulphur metabolism and protein hormones. He recently isolated from tissue of the anterior pituitary gland a crystalline protein having high lactogenic activity, and has also carried on research in the chemistry of insulin.

DR. STERLING TEMPLE, chemical director of the Roessler and Hasslacher Chemicals Department of E. I. du Pont de Nemours and Co., Niagara Falls, N.Y., has been awarded the Jacob F. Schoellkopf gold medal of the Western New York section of the American Chemical Society. Dr. Temple is the eighth recipient of the award, founded in 1931 by Jacob F. Schoellkopf, industrialist and financier. He was general operating superintendent of the phosgene plant of the Oldbury Electrochemical Co. in Niagara Falls during the world war.

OBITUARY

CAPTAIN LIONEL DIGBY WHITEHEAD, J.P., of Goytre Hall, Abergavenny, who founded the Whitehead Iron and Steel Co., Ltd., of which he was chairman and managing director, died in his car near Brecon on March 27, at the age of 61. He was well known in South Wales as an industrialist.

MR. WILLIAM JAGO, analytical chemist and expert on food matters, died at his home in Hove, on March 28. He was 84 years old. Mr. Jago, when Mayor of Hove, entertained the present King and Queen when they were Duke and Duchess of York.

Foreign Chemical Notes

Czechoslovakia

ERECTION OF AN EAU DE COLOGNE FACTORY in Czechoslovakia is contemplated by a financial group in the near future.

Austria

AN EXPERIMENTAL WOOD-SACCHARIFICATION PLANT, applying Dr. Kock's process, is being built in the Timber School at Modling.

China

THE POSSIBILITY OF USING VEGETABLE OILS in place of paraffin oils as illuminants is under examination by the Provincial Government of Fukien.

Roumania

THE VESTA CHEMICAL-PHARMACEUTICAL WORKS, at Oradea, will shortly increase its production of alkaloids to a substantial degree. The present monthly output is 5 to 8 kg. of opium alkaloids.

Esthonia

A FISH MEAL FACTORY IS BEING ERECTED at the mouth of the Embach River for working up smelt.

THE ANNUAL PRODUCTION OF ACETONE from shale oil will be increased from 30 to 80 tons by the Esthonian Shale Oil Co.

Hungary

ZINC WHITE IS NOW BEING MANUFACTURED at Pesterzsebet by the Galvanokemia Farben-und Chemische Fabrik A.G., who are also the only Hungarian producers of a leaded zinc white for outdoor paints. The firm is also embarking upon the manufacture of lead acetate.

Japan

A GLYCERINE FACTORY UTILISING A FERMENTATION PROCESS, with a daily output of 2 tons (later to be increased to 10 tons), is under construction by the Nippon Kayaku K.K. at Aso (Yamaguchi Province).

NATURAL GAS FORMATIONS AT TAIHOKU, in Formosa, have been examined in the Admiralty Laboratory and have been found to be utilisable as a source of alcohol and benzole. The process will be exploited by the Nippon Kogyo Kaisha.

Jugoslavia

RICH NICKEL DEPOSITS have been discovered in the ore-bearing region between Caak and Valjevo.

A NEW WOOD-PULP PRODUCING CONCERN has been established at Videm, near Brezice, under the style of "Franc Bonac, Factory for producing bleached and unbleached Sulphite Cellulose."

PRODUCTION OF MOTOR FUEL FROM LIGNITE is under consideration by the Ministry of Forests and Mines and a decision regarding erection of a plant at an estimated cost of 200 million din. will be come to in a few months.

From Week to Week

THE OFFICIAL PRICE OF PLATINUM was reduced by 10s., to £7 per ounce, on March 25.

UNITED KINGDOM EXPORTS OF TRANSPARENT CELLULOSE WRAPPING for 1937 were 14,498 cwt. (compared with 10,648 cwt. in 1936.)

HENRY BALFOUR AND CO., LTD., Leven, are to supply a preheater and condenser at the Provan Chemical Works of the Glasgow Corporation, at a cost of £950.

THE ISLAND OF SKYE is to have its first petrol station in May. The Scottish Oils and Shell Mex, Ltd., have purchased a site at Portree pier, where petroleum storage tanks are to be built.

THE MINISTRY OF INDUSTRY OF IRAN require tenders for explosives and certain equipment c.i.f. Bender Chahpour. Particulars can be obtained from the Commercial Attaché of Iran, 10-13 South Street, Moorgate, E.C.2.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., have issued another "Girl" calendar for the coming twelve months; on this occasion their choice is a brunette, the winner of the recent "Miss England" Beauty Competition.

LOW MOOR IRON CO., LTD., is to discontinue the manufacture of cold blast and special pig-irons at Low Moor, Bradford, and the whole of the works, including the land, has been acquired by Thos. W. Ward, Ltd., of Sheffield, for breaking up.

A SCHEME IS IN HAND TO ESTABLISH a large oil distillery on Lord Leconfield's Westward Park Estate, three miles from Wigton, Cumberland. Cannel shale which exists near the surface in large quantities shows a high yield of tar oils, gas, and paraffin.

THE GENERAL PURPOSES COMMITTEE of the London County Council have recommended that no objection be made to the Port of London Authority's application to the Ministry of Transport to confirm its new by-laws allowing petroleum ships to proceed up-river as far as Purfleet.

THE 1939 BRITISH INDUSTRIES FAIR will be held in London and Birmingham from February 20 to March 3. Already, within three weeks of the close of the 1938 Fair, 798 exhibitors have applied for 431,500 square feet of space in London and Birmingham next year, or more than half the area occupied this year.

THE COMMERCIAL MOTOR USERS' ASSOCIATION has issued a comprehensive digest of the current construction and use of motor vehicles regulations affecting commercial motor owners and drivers. Copies may be obtained from the Commercial Motor Users' Association, 50 Pall Mall, London, S.W.1. (price 6d.).

CONSIDERABLE PROGRESS HAS BEEN MADE in regard to the ratification by various governments of the agreement considered by the International Sugar Council in London in October. The United States Government is included among those whose ratifications have been made, and most of those outstanding are expected by the end of the month.

THE AMALGAMATED ENGINEERING UNION has concluded a "holidays with pay" agreement with the Iron and Steel Trades Employers' Association, the Cleveland Iron Masters' Association, the West Coast Iron Masters' Association, and the Lincolnshire Iron Masters' Association. The agreement is on similar lines to that made with the Engineering Employers' Federation giving six days' holiday with pay.

FINSBURY TECHNICAL COLLEGE OLD STUDENTS' ASSOCIATION will hold their 26th annual dinner at the Trocadero Restaurant on April 9, at 6.30 for 7 p.m., when the chair will be taken by the president, Dr. C. H. Desch, F.R.S. As usual ladies are invited to be present, and any Old Student may obtain tickets, price 11s. 6d. each, from the Acting Hon. Secretary, Mr. H. P. Guy, "Hadley," Station Road, New Barnet, Herts.

THE BRITISH NICKEL CORPORATION, LTD., a new company formed jointly by important mining concerns in Johannesburg and financial interests in London, is to acquire substantial holdings in the copper-nickel bearing area in Insiza, Southern Rhodesia. It is understood that a prospecting permit covering an area of 100 square miles has been granted to the company. The district concerned is said to be the only important copper-nickel area in the British Empire, apart from the Sudbury area in Canada.

THE MINISTER OF AGRICULTURE, after consultation with the Sugar Commission, has made a supplementary payment of £141,239 in respect of poverty of the crop of home-grown sugar beet in 1937, due to adverse farming conditions in Great Britain generally. This payment is the maximum amount permissible under the Sugar Industry (Reorganisation) Act, 1936, and is being distributed by the British Sugar Corporation among growers at the rate of 6½d. in the pound on the value of beets delivered under the 1937 contract. The average yield of beet in Great Britain in 1937 (8.2 tons an acre) and the average amount of sugar an acre of beet were the lowest since 1931.

TRACES OF OIL HAVE BEEN FOUND 200 ft. below the surface on the coast of Egypt, about 130 miles from the Libyan frontier.

THE PUBLISHED PRICE given for Mellon's "Methods of Quantitative Chemical Analysis" (reviewed in THE CHEMICAL AGE, January 22) should have been 12s. 6d., instead of 15s.

BRADBOURNE, A FAMOUS KENTISH ESTATE, has just been purchased by the East Malling Research Station, whose land adjoins.

JOHN BOWES AND PARTNERS, LTD., announce that the Marley Hill Chemical Works closes down on April 2. The plant has been replaced by a modern works at Monkton, Hebburn.

THE SEAWEED UTILISATION FACTORY now in course of erection at North Boisdale, South Uist, in the Hebrides, is nearing completion. One of its main products will be transparent paper for wrapping purposes.

THERE WILL BE AN ALL ROUND ADVANCE in bleaching prices of 10 per cent. as from April 1. This increase follows the recent advance in dyeing charges. It is understood that the increase has been necessitated by the rising costs of raw materials.

A SUCCESSFUL DINNER AND DANCE was held by the recently inaugurated East Anglian section of the Institute of Chemistry at the Great White Horse Hotel, Ipswich, on March 26. The Mayor and Mayoress of Ipswich were present.

PHIL-SANO, LTD., manufacturers of and dealers in essential oils and perfumery, of 106 Great Russell Street, London, W.C.1, have increased their nominal capital by the addition of £1,000 in £1 7 per cent. cumulative participating preference shares beyond the registered capital of £2,100.

MODERN FUELS, LTD., who purchased the works of Coal and Allied Industries, Ltd., at Seaham Harbour, and intend to produce domestic coke, benzol, and tar products, have virtually completed their first battery of 50 ovens and the lighting-up of the unit will take place within the next two weeks. The warming-up process will take about five weeks, after which the plant will be ready for production.

BRITISH INDUSTRIAL PLASTICS, LTD., formerly the British Cyanides Co., has sold the company's goodwill in the manufacture of certain chemicals—notably yellow prussiate of soda—to the Manchester Oxide Co., Ltd. From now onwards the company will confine its activities to the development of interests in the plastics industry and to the manufacture of chemicals which are directly connected with the plastics industry, states an interim report of the directors just issued.

CONSIDERATION IS BEING GIVEN BY THE GOVERNMENT to the proposals of the Cornish tin producers that a Government subsidy should be granted to enable the mines to be prepared for increased output. The Minister for the Co-ordination of Defence, Sir Thomas Inskip, will receive the tin producers on April 5 in Whitehall, and discuss the kind of grant required to prepare the industry for emergency output. At present the output represents one-tenth of the national consumption.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Morocco.—The Public Health Department of the French Protectorate of Morocco is calling for tenders, to be presented in Casablanca by April 13, for the supply of 2,530 kg. of quinine salts. (Ref. T.Y. 1971.5/38.)

Egypt.—The Egyptian Ministry of Public Health, Stores Department, is calling for tenders for the supply of drugs, etc., which will be required by the Central Stores during the year commencing May 1, 1938. The schedule of requirements covers drugs, chemicals, galenicals and packed articles. Tenders will be received by the Director of Stores, Ministry of Public Health, Cairo, up to May 9. A copy of the schedule of requirements may be inspected at the Department of Overseas Trade.

Egypt.—The Egyptian Department of Survey and Mines is calling for tenders, to be presented in Giza by May 7, for the supply of quantities of sensitive paper for photostat machines developing, and acid fixing powder. (Ref. T.Y.19826/38.)

Greece.—A firm in Athens wishes to obtain the representation, on a commission basis, of United Kingdom suppliers of quinine, wood oil and glycerine. (Ref. No. 219.)

Canada.—A well-established firm of agents at Toronto wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of stearic and animal fatty acids for the Province of Ontario. (Ref. No. 213.)

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Applications for Patents

LEAD ALLOYS.—American Smelting and Refining Co. (United States, March 19, '37.) 8650.

MANUFACTURE OF ALUMINIUM STEARATE GREASE.—C. Arnold (Standard Oil Development Co.). 8474.

MANUFACTURE OF STEEL.—H. A. Brassert and Co. (Colclough). 8476.

MANUFACTURE OF IRON.—H. A. Brassert and Co., Ltd. (Rochling'sche Eisen und Stahlwerke). 8505.

HALOGEN DERIVATIVES OF RUBBER.—British Rubber Producers' Research Association, H. P. Stevens, and F. J. W. Popham. 8758.

MANUFACTURE OF TUBULAR METAL PRODUCTS.—H. W. Brownsdon, and Imperial Chemical Industries, Ltd. 8304.

PRODUCTION OF BASE-EXCHANGING ADSORBENTS stable to temperature changes.—Carbo-Norit-Union Verwaltungs Ges. (Germany, March 17, '37.) 8312.

MANUFACTURE OF SODIUM CARBONATE.—L. Champy, and A. J. Noordam. (Belgium, March 20, '37.) 8683.

TREATMENT OF ALIPHATIC ALDEHYDES.—Distillers Co., Ltd., and H. L. Maxfield. 8787.

ARYL MONO-SUBSTITUTED OLEFINES.—Distillers Co., Ltd., and H. M. Stanley. 8530.

MANUFACTURE OF AZO-DYESTUFFS, ETC.—E. I. du Pont de Nemours and Co. (United States, March 23, '37.) 8305.

FIRE-PROOFING OF COMBUSTIBLE ORGANIC MATERIALS.—E. I. du Pont de Nemours and Co. (United States, March 23, '37.) 8964.

MANUFACTURE OF AMINOANTHRAQUINONE SULPHONIC ACIDS.—E. I. du Pont de Nemours and Co., H. R. Lee, and D. X. Klein. 8965.

PREPARATION OF NUCLEAR ALKYLATED, ETC., DERIVATIVES OF MORPHINE, ETC.—W. U. Dykes (Research Corporation, Small and Fitch). (May 5, '37.) 8779.

PREPARATION OF THERAPEUTICALLY-ACTIVE PRODUCTS from yeast. G. B. Ellis (Chemical Works, formerly Sandoz). 8930.

FILMS, FILAMENTS, ETC., from solutions of proteins.—E. C. Fieldsend, W. H. D. Boyes, and Imperial Chemical Industries, Ltd. 8659.

PRODUCTION OF AZO DEYSTUFFS.—J. R. Geigy, A.-G. (Switzerland, March 19, '37.) 8264.

MANUFACTURE, ETC., OF ALLOYS.—General Electric Co., Ltd., and C. J. Smithells. 8905.

MANUFACTURE OF WATER INSOLUBLE AZO-DYESTUFFS containing metal.—W. W. Groves (I. G. Farbenindustrie.) 8271.

MANUFACTURE OF AZO-DYESTUFFS insoluble in water.—W. W. Groves (I. G. Farbenindustrie.) 8390.

MANUFACTURE OF ACYL-ACETIC ARYLIDES having substantive properties.—W. W. Groves (I. G. Farbenindustrie.) 8391.

MANUFACTURE OF SOLID DIAZONIUM SALTS.—W. W. Groves (I. G. Farbenindustrie.) 8629.

MANUFACTURE OF MONOAZO-DYESTUFFS.—W. W. Groves (I. G. Farbenindustrie.) 8910.

MANUFACTURE OF CONDENSATION PRODUCTS of the anthraquinone series.—I. G. Farbenindustrie. (Germany, March 17, '37.) 8318.

MANUFACTURE OF ETHER-ALCOHOL DERIVATIVES.—I. G. Farbenindustrie. (Austria, March 18, '37.) 8392.

MANUFACTURE OF SYNTHETIC RUBBER-LIKE MATERIALS.—I. G. Farbenindustrie. (Germany, March 20, '37.) 8672; (Germany, Nov. 11, '37.) 8673.

MANUFACTURE, ETC., OF INTERPOLYMERISATION PRODUCTS.—G. W. Johnson (I. G. Farbenindustrie.) 8462.

DYEING OF TEXTILES.—G. W. Johnson (I. G. Farbenindustrie.) 8463.

MANUFACTURE, ETC., OF CHROMIUM, ETC.—G. W. Johnson (I. G. Farbenindustrie.) 8464.

MANUFACTURE OF CONVERSION COMPOUNDS OF PYRENE.—G. W. Johnson (I. G. Farbenindustrie.) 8465.

COATING OF RUBBER, ETC., SURFACES.—G. W. Johnson (I. G. Farbenindustrie.) 8466.

SPLITTING OF HYDROCARBONS.—G. W. Johnson (I. G. Farbenindustrie.) 8667.

MANUFACTURE, ETC., OF NICKEL CARBONYL.—G. W. Johnson (I. G. Farbenidustrie.) 8668.

PREPARATION OF OPTICALLY ACTIVE β- (p-OXYPHENYL)-ISOPROPYL-METHYLAMINES.—Knoll, A.-G. (Germany, April 17, '37.) 8947.

MANUFACTURE OF RESINS.—Kodak, Ltd. (Eastman Kodak Co.). 8825, 8826, 8827, 8828.

MANUFACTURE OF STEEL.—F. Krupp (Germany, March 31, 37.) 8748; (Germany, Nov. 23, '37.) 8749; (Germany, Sept. 30, '37.) 8823.

PRODUCTION OF ALPHA-SUBSTITUTED GLYCEROL NITRATES.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. (United States, March 22, '37.) 8670.

POLYMERISATION OF OLEFINES.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. (United States, March 26, '37.) 8946.

MANUFACTURE OF POTASSIUM PERSULPHATE.—B. Laporte, Ltd. (France, March 31, '37.) 8632.

COLOUR TREATMENT OF ANODISED ALUMINIUM, ETC.—W. J. Leeder. 8210.

MANUFACTURE OF CYCLOPENTANO-DIMETHYL-POLYHYDRO PHENANTHRENE DERIVATIVES.—Naamlooze Vennootschap Organon. (Switzerland, March 22, '37.) 8658.

MANUFACTURE, ETC., OF SATURATED, ETC., DERIVATIVES OF PREGNANE-DIONE.—Naamlooze Vennootschap Organon. (Switzerland, March 24, '37.) 8830.

MANUFACTURE, ETC., OF MILK OF MAGNESIA.—A. W. Pauley. (United States, March 20, '37.) 8359.

MANUFACTURE OF LEAD CHROMATE.—Priestman Collieries, Ltd., and T. G. French. 8548.

PRODUCTION OF STEEL.—Rochling'sche Eisen- und Stahlwerke Ges. (Germany, March 22, '37.) 8593; (Germany, Sept. 20, '37.) 8594.

METHOD, ETC., FOR REMOVING THE VAPORABLE CONTENTS from carbonaceous materials.—A. C. Russell, and C. W. Garven. (Australia, March 25, '37.) 8693.

PREPARATION OF VOLATILE PRODUCTS FOR PITCH, ETC.—Rütgerswerke, A.-G., and L. Kahl. (Germany, Jan. 12.) 8831.

METHOD, ETC., FOR OBTAINING, ETC., THERAPEUTICALLY EFFICACIOUS PREPARATIONS.—F. Schütz. (Austria, March 23, '37.) 8652; (Austria, Feb. 24.) 8653.

MANUFACTURE OF BERYLLIUM OXIDE.—Seri Holding Soc. Anon. (Luxembourg, March 23, '37.) 8671.

PROCESS, ETC., FOR EFFECTING METALLURGICAL REACTIONS.—Soc. d'Electrochimie, d'Electrometallurgie, et des Acieries Electriques d'Ugine. (France, March 26, '37.) 8958.

MANUFACTURE, ETC., OF THERAPEUTICALLY ACTIVE ORGANIC COMPOUNDS.—Soc. des Usines Chimiques Rhone-Poulenc. (Germany, April 1, '37.) 8293; (Germany, July 26, '37.) 8294.

MANUFACTURE OF INTERMEDIATE PRODUCTS.—Soc. of Chemical Industry in Basle. (Nov. 6, '36.) (Switzerland, Nov. 6, '35.) 8270.

Specifications Open to Public Inspection

DEHYDROGENATION OF ALIPHATIC HYDROCARBONS.—Universal Oil Products Co. Sept. 17, 1936. 9084/37.

PROCESS OF SEPARATING NITRILE-HYDROCARBON MIXTURES.—Armour and Co. Sept. 14, 1936. 10271/37.

PROCESS OF MAKING ALKALI SUB-SILICATES.—Pennsylvania Salt Manufacturing Co. Sept. 17, 1936. 22615.

MANUFACTURE OF 2-ALKYLHEXAHYDROBENZTHIAZOLES and 2-alkylhexahydrobenzselenazoles.—I. G. Farbenindustrie. Sept. 16, 1936. 24886/37.

CARBAZOLE-ALKYL KETONES.—Armour and Co. Sept. 19, 1936.

MANUFACTURE OF INTERMEDIATE PRODUCTS.—Soc. of Chemical Industry in Basle. Nov. 6, 1935. 8270/37.

Specifications Accepted with Dates of Application

DISTILLATION OF COAL and other solid carbonaceous substances. F. W. Salisbury-Jones, and R. Nisbet. June 6, 1936. 481,584.

TREATING PALLADIUM and products of such process.—American Platinum Works, and J. S. Streicher. June 11, 1936. 481,648.

MANUFACTURE OF POROUS ARTICLES from natural or synthetic rubber.—C. E. Every-Clayton (Soc. de Progres Technique). Aug. 13, 1936. (Cognate Application, 22370/36. 481,871.

PROCESS FOR THE MANUFACTURE OF N-BASICALLY SUBSTITUTED AMINO COMPOUNDS of the heterocyclic series.—A. Carpmael (I. G. Farbenindustrie.) Aug. 14, 1936. (Sample furnished.) 481,874.

PRODUCTION OF VALUABLE HYDROCARBON PRODUCTS by the thermal treatment of distillable residues produced in the destructive hydrogenation of carbonaceous materials.—H. E. Potts (International Hydrogenation Patents Co., Ltd.). Aug. 15, 1936. 481,875.

PRODUCTION OF OXYGENATED ORGANIC COMPOUNDS from unsaturated hydrocarbons.—C. Arnold (Standard Oil Development Co.). Aug. 15, 1936. (Sample furnished.) 481,795.

MANUFACTURE OF MIXED CARBIDES and of articles made therefrom.—Keramet Ges Fur Keramisches Metall Ges. Nov. 11, 1935. 481,876.

MANUFACTURE OF NITROSAMINES.—W. W. Groves (I. G. Farbenindustrie.) Sept. 14, 1936. 481,735.

MANUFACTURE OF STEEL.—Rochling'sche Eisen-Und Stahlwerke Ges. Sept. 25, 1935. 481,878.

PROCESS FOR THE MANUFACTURE OF A SULPHONE.—A. Carpmael (I. G. Farbenindustrie.) Sept. 15, 1936. 481,673.

RECOVERY OF COPPER from waste liquors of the artificial silk industry.—I. G. Farbenindustrie. Nov. 23, 1935. 481,741.

MANUFACTURE OF SINTERED HARD METALLIC ALLOYS.—W. H. Hatfield, and H. Burden. Sept. 17, 1936. 481,805.

MANUFACTURE AND PRODUCTION OF MOTOR FUELS of low-boiling point—G. W. Johnson (I. G. Farbenindustrie). Sept. 18, 1936. 481,607.

PREVENTION OF CORROSION IN METAL ARTICLES.—Winn and Coales, Ltd., and F. B. Coales. Sept. 17, 1936. 481,606.

ANTHRAQUINONE DYESTUFFS.—W. W. Tatum, and Imperial Chemical Industries, Ltd. Sept. 17, 1936. 481,942.

MANUFACTURE OF AZO-DYESTUFFS insoluble in water.—W. W. Groves (I. G. Farbenindustrie.) Sept. 18, 1936. 481,747.

PRODUCTION OF TITANIUM DIOXIDE PIGMENTS.—W. J. Tennant (Titan Co., Inc.). Sept. 18, 1936. 481,892.

METHOD OF REDUCING THE CORROSIVE EFFECT OF NITROGENOUS BASES ON METALS.—R. W. Moncrieff, and E. B. Thomas. Sept. 19, 1936. 481,748.

MANUFACTURE OF DYESTUFFS of the anthraquinone series.—I. G. Farbenindustrie. Sept. 21, 1935. 481,897.

PRODUCTION OF GLUTAMIC ACID AND PLUTAMATES.—J. Schindelmeiser. Sept. 19, 1936. 481,898.

MANUFACTURE AND PRODUCTION OF BUTADIENE.—G. W. Johnson (I. G. Farbenindustrie.) Sept. 21, 1936. 481,612.

MANUFACTURE OF AROMATIC COMPOUNDS alkylated in the nucleus. W. W. Groves (I. G. Farbenindustrie.) Sept. 22, 1936. 481,909.

PLASTIC COMPOSITIONS.—A. E. Bond. Nov. 2, 1936. 481,620.

METHOD OF AND MEANS FOR DEPOSITING ONE METAL ALLOY UPON ANOTHER.—W. A. Oubridge, and E. Carpenter. Nov. 21, 1936. 481,683.

PRODUCTION OF NITRIC ACID.—W. Rudbach. Dec. 14, 1936. 481,629.

DECOMPOSITION OF WOOD for the production of cellulose.—T. Kleinert. Dec. 31, 1935. 481,631.

MANUFACTURE OF NITRO DYESTUFFS.—A. Carpmael (I. G. Farbenindustrie.) Jan. 9, 1937. 481,633.

REFINEMENT OF MAGNESIUM AND MAGNESIUM ALLOYS.—P. Briske and A. Luschenowsky. Feb. 3, 1936. 481,637.

STABILISING ORGANIC SULPHIDES.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Nov. 26, 1936. 481,642.

MANUFACTURE OF AZO-DYESTUFFS.—J. R. Geigy, A.-G. May 6, 1936 481,832

GASEFYING OIL OR TAR with or without admixture with coal and like carbonaceous materials containing cyclic hydrocarbons. S. A. Kiss. May 14, 1937. 481,835.

MANUFACTURE OF BUTADIENE.—Standard Oil Development Co. July 15, 1936. 481,646.

EFFECTING THE DEOXIDATION OF COPPER.—Soc. D'Electro-Chimie, D'Electro-Metallurgie, et des Acieries Electriques D'Ugine. June 16, 1936. 481,844.

TREATMENT OF HYDROCARBON OILS by the Edeleanu process.—Edeleanu-Ges. June 20, 1936. 481,647.

TREATMENT OF CELLULOSE ESTERS.—Kodak, Ltd. July 3, 1936. 481,845.

EXTRACTING VALUABLE SUBSTANCES from synthetic process gases. Carbo-Norit-Union Verwaltungs-Ges. Aug. 24, 1936. 481,850.

DYEING COTTON AND ARTIFICIAL SILK from regenerated cellulose.—Durand and Huguenin, A.-G. July 18, 1936. 481,854.

MANUFACTURE AND PRODUCTION OF SYNTHETIC SPINELS.—I. G. Farbenindustrie. July 29, 1936. 481,857.

PROCESS FOR THE MANUFACTURE OF 2, 4-dioxo-3, 3-di-allyl- and di-n-propyl.6-methyl-1, 2, 3, 4-tetrahydropyridines.—F. Hoffman-La Roche and Co., A.-G. Dec. 2, 1936. 481,863.

TREATMENT OF CELLULOSE ESTERS or cellulose ethers.—Soc. Rhodiaceta. July 31, 1936. 481,927.

PROCESS FOR THE MANUFACTURE OF COMPOUNDS from acetohalogen-sugars and nicotinic acid amide.—F. Hoffman-La Roche and Co., A.-G. Dec. 8, 1936. 481,864.

SULPHIDISED MATERIALS obtained from naturally occurring resins.—R. F. Powell. July 16, 1936. 481,934.

Forthcoming Events

London.

April 4.—Society of Chemical Industry. Joint Meeting with the Chemical Engineering Group. Burlington House, Piccadilly, W.1. 8 p.m. Major H. J. W. Bliss, "Modern Trade Mark Law."

April 5.—Institution of Civil Engineers. Great George Street, Westminster, S.W.1. 6 p.m. F. Fancutt, "The Work of the Paint Research Laboratory of the London, Midland and Scottish Railway Co."

April 7.—Institute of Fuel. Junior Institution of Engineers, 39 Victoria Street, S.W.1. 6 p.m. G. M. Gill and Leon. B. Jones, "Manufacture of Coal Gas from Fuel Oil."

April 12.—Society of Chemical Industry (Plastics Group). Burlington House, Piccadilly, W.1. 7.30 p.m. "Colourless Kotonic Resins."

Birmingham.

April 5.—Society of Chemical Industry. Chamber of Commerce Buildings, New Street. 7.30 p.m. Annual Meeting. D. W. Parkes and R. B. Evans, "A New Absorbent for the Recovery of Carbon Dioxide." Electrodepositors' Technical Society. Birmingham Conference. "Bright Metal Coatings."

Derby.

April 5.—British Association of Chemists.. Notts and Derby Section. Annual Meeting. Irongates, Derby.

Glasgow.

April 8.—Oil and Colour Chemists' Association (Scottish Section). Annual General Meeting. Sloan's Arcade Café.

Leicester.

April 8.—Institute of Chemistry (East Midlands Section). 7.45 p.m. Annual General Meeting. Bell Hotel. 8 p.m. Dr. C. Ainsworth Mitchell, "Forgers and Forgeries."

Liverpool.

April 6.—British Association of Chemists. Liverpool Section Annual Meeting. Exchange Hotel.

Manchester.

April 5.—Society of Chemical Industry (Manchester Section). Annual General Meeting. Constitutional Club, St. Ann's Street. 7 p.m.

April 8.—Oil and Colour Chemists' Association (Manchester Section). Annual General Meeting.

Society of Dyers and Colourists (Manchester Society). Literary and Philosophical Society, 36 George Street. 7 p.m. Annual Meeting and Symposium on "Dyeing Difficulties and

Chemical and Allied Stocks and Shares

NO doubt owing to the widespread tendency to await the Budget the stock and share markets have again shown inactive and uncertain conditions this week. No heavy selling pressure was reported, but on balance movements, although moderate in character, have been mostly against holders. It is felt in many quarters, however, that the recent dividend decisions of leading industrial companies, such as Imperial Chemical Industries and Dunlop Rubber indicate confidence in the general trade outlook.

Among shares of companies identified with the chemical and kindred industries, Imperial Chemical have fluctuated closely in accordance with the day-to-day trend of markets and at the time of writing are 29s. 10½d. compared with 29s. 9d. a week ago. Turner and Newall were lower at 67s., as were British Oxygen at 73s., although the market is continuing to take the view that the latter company is likely to at least maintain its dividend at 15 per cent., and that there may be some form of bonus. Murex were most active around 82s., partly on the possibility of a small increase in the impending interim payment. It is possible, however, that in view of the near approach of the Budget most companies will decide to leave all question of a larger dividend until the final payment for the year. Associated Portland Cement continued reactionary on doubts whether it will be possible to maintain the dividend at 22½ per cent. for 1938. It is realised, however, that considerable further strength will be added to the company's position by the absorption of Alpha Cement. British Plaster Board at 26s. 3d., have not held best prices and Wall Paper deferred have moved down further to 35s. 3d. at the time of writing. On the basis of last year's 12½ per cent. dividend the yield on the last named works out at over 7 per cent.

Boots Pure Drug were fairly steady subsequently, although on balance for the week the price has moved down 6d. to 42s. The market is confident the 24 per cent. dividend and 5 per cent., tax free, bonus distributions, which have ruled for many years, will be maintained. British Drug Houses were inactive, but have been maintained around 23s. 9d., there being hopes that the dividend will be kept at 6 per cent. Cooper, McDougall and Robertson were moderately lower on balance, and Fison Packard and Prentice at 33s. 6d. have not held best prices. British Oil and Cake Mills preferred moved down moderately to 45s. 3d., and United Premier Oil and Coke ordinary lost a few pence to 7s. 6d. B. Laporte were again quoted at 82s. 6d. Monsanto Chemicals preference kept around 22s. 6d., while Greeff Chemicals Holdings 5s. ordinary units remained at 6s. 3d., although the price did not appear to be tested by much business. British Industrial Plastics were more active, but failed to benefit from the progress report. British Glues were inactive and continue to be quoted at 5s. 7½d. Blythe Colour Works was another share which received very little attention. William Blythe 3s. shares were around 5s. 6d.; the company is maintaining its dividend at 10 per cent.

Lever and Unilever have reacted to 34s. 3d., and most other shares with an international market have moved against holders, including Swedish Match which are now 22s., and International Nickel which have gone back to $42½. "Shell" and other leading oil shares were lower under the influence of the increasing stocks of oil in the United States, which according to current market views, will, if continued, result in a reduction in oil prices during the next few months. The dividends of the "Shell," Anglo-Iranian and other leading oil companies fall to be announced in May.

Weekly Prices of British Chemical Products

NEARLY all sections of the chemical market have been moderately active during the past week. A slight improvement is reported in the volume of spot inquiries, but the actual business being put through cannot be regarded as substantial. So far as contract deliveries are concerned these appear to be going forward with fair regularity, but there is a complete absence of any fresh long-term buying orders. Values throughout the market are steady and quotations are unaltered at recent levels. There is little change in the market position for coal tar products. A small spot inquiry is reported and buyers appear to be reluctant to enter into contract commitments. In the meantime the accumulation of stocks is having a depressing effect on quotations.

MANCHESTER.—There has been relatively little change in the general condition of the chemical trade on the Manchester market during the past week. So far as most heavy descriptions are concerned, values are on a firm basis and fair quantities are being covered by current delivery specifications, but there has been little important expansion in the volume of new business. The leading alkali and acid products, as well as the potash compounds, are moving into consumption at about the rate experienced during the past month or so, with the textile dyeing and finishing trades taking rather less than could be desired. Decidedly dull conditions continue to be reported in respect of the by-products and with sellers more prominent than buyers the tone of several classes is undoubtedly easy.

Price Changes

Falls: Copper Sulphate (Manchester); Carbolic Acid, crystals (Manchester); Naphthalene, crude, whizzed or hot pressed; Pyridine (Manchester); Xylol.

GLASGOW.—There has been a slight improvement in the demand for general chemicals for home trade during the week, but export inquiries remain very limited. Prices generally continue very firm at about last week's levels, with no important changes to report.

General Chemicals

ACETONE.—**£45 to £47 per ton.**

ACETIC ACID.—Tech, 80%, £30 5s. per ton; pure 80%, £32 5s.; tech., 40%, £15 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. MANCHESTER: 80%, commercial, £30 5s.; tech. glacial, £42 to £46.

ALUM.—Loose lump, £8 7s. 6d. per ton d/d; GLASGOW: Ground, £10 7s. 6d. per ton; lump, £9 17s. 6d.

ALUMINIUM SULPHATE.—£7 2s. 6d. per ton d/d Lancs. GLASGOW: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 1s. to 1s. 1d. per lb. d/d in cylinders. SCOTLAND: 10¼d. to 1s. 0¼d., containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM CARBONATE.—£20 per ton d/d in 5 cwt. casks.

AMMONIUM CHLORIDE.—Grey galvanising, £19 per ton, ex wharf.

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

AMMONIUM DICHROMATE.—8¼d. per lb. d/d U.K.

ANTIMONY OXIDE.—£68 per ton.

ARSENIC.—Continental material £11 per ton c.i.f., U.K. ports; Cornish White, £12 5s. to £12 10s. per ton f.o.r., mines, according to quantity. MANCHESTER: White powdered Cornish, £16 10s. per ton, ex store.

BARIUM CHLORIDE.—£11 10s. to £12 10s. per ton in casks ex store. GLASGOW: £11 10s. per ton.

BLEACHING POWDER.—Spot, 35/37%, £9 5s. per ton in casks, special terms for contracts. SCOTLAND: £9 per ton net ex store.

BORAX COMMERCIAL.—Granulated, £16 per ton; crystal, £17; powdered, £17 10s.; extra finely powdered, £18 10s., packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Granulated, £16, crystal, £17; powdered, £17 10s. per ton in 1-cwt. bags, carriage paid.

BORIC ACID.—Commercial granulated, £28 10s. per ton; crystal, £29 10s.; powdered, £30 10s.; extra finely powdered, £32 10s. in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Crystals, £29 10s.; powdered, £30 10s. 1-cwt. bags in 1-ton lots.

CALCIUM BISULPHITE.—£6 10s. per ton f.o.r. London.

CHARCOAL, LUMP.—£6 to £6 10s. per ton, ex wharf. Granulated, £7 to £9 per ton according to grade and locality.

CHROMETAN.—Crystals, 2⅛d. per lb.; liquor, £19 10s. per ton d/d. station in Drums. GLASGOW: 70/75% solid, £5 15s. per ton net ex store.

CHROMIC ACID.—9¾d. per lb., less 2½%; d/d U.K.

CHROMIUM OXIDE.—11d. per lb.; d/d U.K.

CITRIC ACID.—1s. 0¼d. per lb. MANCHESTER: 1s. 0¼d. SCOTLAND: B.P. crystals, 1s. 0¼d. per lb.; less 5%, ex store.

COPPER SULPHATE.—£21 7s. 6d. per ton, less 2% in casks. MANCHESTER: £18 15s. per ton f.o.b. SCOTLAND: £19 5s. per ton, less 5%, Liverpool, in casks.

CREAM OF TARTAR.—100%, 92s. per cwt., less 2½%. GLASGOW: 99%, £4 12s. per cwt. in 5-cwt. casks.

FORMALDEHYDE.—£20-£22 per ton.

FORMIC ACID.—85%, in carboys, ton lots, £42 to £47 per ton.

GLYCERINE.—Chemically pure, double distilled, 1.260 s.g., in tins, £4 12s. 6d. to £5 12s. 6d. per cwt. according to quantity; in drums, £4 5s. 0d. to £4 17s. 6d.

HYDROCHLORIC ACID.—Spot, 5s. 6d. to 8s. carboy d/d according to purity, strength and locality.

IODINE.—Resublimed B.P., 6s. 4d. per lb. in 7 lb. lots.

LACTIC ACID.—(Not less than ton lots). Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50%, by vol., £41. One-ton lots ex works, barrels free.

LEAD ACETATE.—LONDON: White, £31 10s. ton lots; brown, £35. GLASGOW: White crystals, £32; brown, £1 per ton less. MANCHESTER: White, £32; brown, £31.

LEAD, NITRATE.—£32 per ton for 1-ton lots.

LEAD, RED.—£32 15s. 0d. 10 cwt. to 1 ton, less 2½% carriage paid. SCOTLAND: £32 per ton, less 2¼% carriage paid for 2-ton lots.

LITHARGE.—SCOTLAND: Ground, £32 per ton, less 2½%, carriage paid for 2-ton lots.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.

MAGNESIUM CHLORIDE.—SCOTLAND: £7 10s. per ton.

MAGNESIUM SULPHATE.—Commercial, £5 10s. per ton, ex wharf.

MERCURY.—Ammoniated B.P. (white precip.), lump, 5s. 10d. per lb.; powder B.P., 6s. 0d.; bichloride B.P. (corros. sub.) 5s. 1d.; powder B.P. 4s. 9d.; chloride B.P. (calomel), 5s. 10d.; red oxide cryst. (red precip.), 6s. 11d.; levig. 6s. 5d.; yellow oxide B.P. 6s. 3d.; persulphate white B.P.C., 6s. 0d.; sulphide black (hyd. sulph. cum sulph. 50%), 5s. 11d. For quantities under 112 lb., 1d. extra; under 28 lb., 5d. extra.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

NITRIC ACID.—Spot, £25 to £30 per ton according to strength, quantity and destination.

OXALIC ACID.—£48 15s. to £57 10s. per ton, according to packages and position. GLASGOW: £2 9s. per cwt. in casks. MANCHESTER: £49 to £54 per ton ex store.

PARAFFIN WAX.—SCOTLAND: 3¾d. per lb.

POTASH CAUSTIC.—Solid, £35 5s. to £36 15s. per ton for 2-ton lots ex store; broken, £42 per ton. MANCHESTER: £39.

POTASSIUM CHLORATE.—£36 7s. 6d. per ton. GLASGOW: 4¼d. per lb. MANCHESTER: £37 10s. per ton.

POTASSIUM DICHROMATE.—5¼d. per lb. carriage paid. SCOTLAND: 5¼d. per lb., net, carriage paid.

POTASSIUM IODIDE.—B.P. 5s. 6d per lb. in 7 lb. lots.

POTASSIUM NITRATE.—Small granular crystals, £24 to £27 per ton ex store, according to quantity. GLASGOW: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 9¾d. per lb. SCOTLAND: B.P. Crystals, 9¾d. MANCHESTER: B.P. 10¾d. to 1s.

POTASSIUM PRUSSIATE.—6½d. per lb. SCOTLAND: 7d. net, in casks, ex store. MANCHESTER: Yellow, 6½d.

SALAMMONIAC.—Firsts lump, spot, £42 17s. 6d. per ton, d/d address in barrels. Dog-tooth crystals, £36 per ton; fine white crystals, £18 per ton, in casks, ex store. GLASGOW: Large crystals, in casks, £37 10s.

SALT CAKE.—Unground, spot, £3 11s. per ton.

SODA ASH.—58% spot, £5 17s. 6d. per ton f.o.r. in bags.

SODA, CAUSTIC.—Solid, 76/77° spot, 13s. 10s. per ton d/d station. SCOTLAND: Powdered 98/99%, £18 10s. in drums, £19 5s. in casks, Solid 76/77° £15 12s. 6d. in drums; 70/73%, £15 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts, 10s. per ton less.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—£19-£20 per ton carriage paid North. GLASGOW: £18 10s. per ton net ex store.

SODIUM BICARBONATE.—Refined spot, £10 15s. per ton d/d station in bags. GLASGOW: £13 5s. per ton in 1 cwt. kegs, £11 5s. per ton in 2-cwt. bags. MANCHESTER: £10 10s.

SODIUM BISULPHITE POWDER.—60/62%, £20 per ton d/d 1 cwt. iron drums for home trade.

SODIUM CARBONATE MONOHYDRATE.—£20 per ton d/d in minimum ton lots in 2 cwt. free bags.

SODIUM CHLORATE.—£27 10s. to £32 per ton. GLASGOW: £1 11s. per cwt., minimum 3 cwt. lots.

SODIUM DICHROMATE.—Crystals cake and powder 4½d. per lb. net d/d U.K. with rebates for contracts. MANCHESTER:

SODIUM CHROMATE.—4½d. per lb. d/d U.K.

4d. per lb. GLASGOW: 4½d. net, carriage paid.

SODIUM HYPOSULPHITE.—Pea crystals, £15 5s. per ton for 2-ton lots; commercial, £11 5s. per ton. MANCHESTER: Commercial, £11; photographic, £15 10s.

SODIUM METASILICATE.—£14 5s. per ton, d/d U.K. in cwt. bags.

SODIUM NITRATE.—Refined, £8 per ton for 6-ton lots d/d. GLASGOW: £1 12s. 0d. per cwt. in 1-cwt. kegs, net, ex store.

SODIUM NITRITE.—£18 5s. per ton for ton lots.

SODIUM PERBORATE.—10%, 9½d. per lb. d/d in 1-cwt. drums.

SODIUM PHOSPHATE.—Di-sodium, £12 per ton delivered for ton lots. Tri-sodium, £15 to £16 per ton delivered per ton lots.

SODIUM PRUSSIATE.—...d. per lb. for ton lots. GLASGOW: 5d. to 5¾d. ex store. MANCHESTER: 4¼d. to 5¼d.

SODIUM SILICATE.—£8 2s. 6d. per ton.

SODIUM SULPHATE (GLAUBER SALTS).—£3 per ton d/d.

SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 to £3 10s. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 12s. 6d.

SODIUM SULPHIDE.—Solid 60/62%, Spot, £11 15s. per ton d/d in drums; crystals, 30/32%, £9 per ton d/d in casks. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8 10s.

SODIUM SULPHITE.—Pea crystals, spot, £14 10s. per ton d/d station in kegs.

SULPHUR PRECIP.—B.P., £55 to £60 per ton according to quantity. Commercial, £50 to £55.

SULPHURIC ACID.—168° Tw., £4 11s. to £5 1s. per ton; 140° Tw., arsenic-free, £3 to £3 10s.; 140° Tw., arsenious, £2 10s.

TARTARIC ACID.—1s. 1¼d. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. MANCHESTER: 1s. 1¼d. per lb. GLASGOW: 1s. 1d. per lb., 5%, ex store.

ZINC SULPHATE.—Tech., £11 10s. f.o.r., in 2 cwt. bags.

Rubber Chemicals

ANTIMONY SULPHIDE.—Golden, 7d. to 1s. 2d. per lb., according to quality. Crimson, 1s. 6d. to 1s. 7½d. per lb.

ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.

BARYTES.—£6 to £6 10s. per ton, according to quality.

CADMIUM SULPHIDE.—6s. to 6s. 3d. per lb.

CARBON BLACK.—4d. per lb., ex store.

CARBON DISULPHIDE.—£31 to £33 per ton, according to quantity, drums extra.

CARBON TETRACHLORIDE.—£41 to £46 per ton, according to quantity, drums extra.

CHROMIUM OXIDE.—Green, 10½d. to 11d. per lb.

DIPHENYLGUANIDINE.—2s. 2d. per lb.

INDIA-RUBBER SUBSTITUTES.—White, 4¾d. to 5½d. per lb.; dark 4d. to 4½d. per lb.

LAMP BLACK.—£24 to £26 per ton del., according to quantity. Vegetable black, £35 per ton upwards.

LEAD HYPOSULPHITE.—9d. per lb.

LITHOPONE.—30%, £17 to £17 15s. per ton.

SULPHUR.—£9 to £9 5s. per ton. SULPHUR PRECIP. B.P., £55 to £60 per ton. SULPHUR PRECIP. COMM., £50 to £55 per ton.

SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quantity.

VERMILION.—Pale, or deep, 5s. per lb., 1-cwt. lots.

ZINC SULPHIDE.—£58 to £60 per ton in casks ex store, smaller quantities up to 1s. per lb.

Nitrogen Fertilisers

AMMONIUM SULPHATE.—The following prices have been announced for neutral quality basis 20.6% nitrogen, in 6-ton lots delivered farmer's nearest station up to June 30, 1938: November, £7 8s.; December, £7 9s. 6d.; January, 1938, £7 11s.; February, £7 12s. 6d.; March/June, £7 14s.

CALCIUM CYANAMIDE.—The following prices are for delivery in 5-ton lots, carriage paid to any railway station in Great Britain up to June 30, 1938: November, £7 10s.; December, £7 11s. 3d.; January, 1938, £7 12s. 6d.; February, £7 13s. 9d.; March, £7 15s.; April/June, £7 16s. 3d.

NITRO CHALK.—£7 10s. 6d. per ton up to June 30, 1938.

SODIUM NITRATE.—£8 per ton for delivery up to June 30, 1938.

CONCENTRATED COMPLETE FERTILISERS.—£11 4s. to £11 13s. per ton in 6-ton lots to farmer's nearest station.

AMMONIUM PHOSPHATE FERTILISERS.—£10 19s. 6d. to £14 16s. 6d. per ton in 6-ton lots to farmer's nearest station.

Coal Tar Products

BENZOL.—At works, crude, 9¼d. to 9¾d. per gal.; standard motor, 1s. 2¾d. to 1s. 3¼d.; 90%, 1s. 3¾d. to 1s. 4¼d.; pure, 1s. 7¾d. to 1s. 8¼d. GLASGOW: Crude, 10d. to 10½d. per gal.; motor, 1s. 4d. to 1s. 4½d.

CARBOLIC ACID.—Crystals, 7¾d. to 8¼d. per lb., small quantities would be dearer; Crude, 60's, 3s. 6d. to 3s. 9d.; dehydrated, 4s. 4½d. to 4s. 7½d. per gal. MANCHESTER: Crystals, 7½d. per lb. f.o.b. in drums; crude, 3s. to 3s. 6d. per gal.

CREOSOTE.—Home trade, 5¾d. per gal., f.o.r. makers' works; exports, 6¾d. to 6¾d. per gal., according to grade. MANCHESTER: 4½d. to 5½d. GLASGOW: B.S.I. Specification, 6d. to 6½d. per gal.; washed oil, 5d. to 5½d.; lower sp. g. oils, 5¾d. to 6¼d.

CRESYLIC ACID.—97/99%, 2s. 5d. to 2s. 8d.; 99/100%, 4s. to 5s. 6d. per gal., according to specification; Pale, 99/100%, 2s. 9d. to 3s.; Dark, 95%, 2s. 4d. to 2s. 5½d. per gal. GLASGOW: Pale, 99/100%, 5s. to 5s. 6d. per gal.; pale, 97/99%, 4s. 6d. to 4s. 10d., dark, 97/99%, 4s. 3d. to 4s. 6d.; high boiling acids, 2s. to 2s. 6d. American specification, 3s. 9d. to 4s. MANCHESTER: Pale, 99/100%, 3s.

NAPHTHA.—Solvent, 90/160, 1s. 6d. to 1s. 7d. per gal.; solvent, 95/160%, 1s. 7d. to 1s. 8d., naked at works; heavy 90/190%, 1s. 1½d. to 1s. 3d. per gal., naked at works, according to quantity. GLASGOW: Crude, 6½d. to 7½d. per gal.; 90%, 160, 1s. 5d. to 1s. 6d., 90%, 190, 1s. 1d. to 1s. 3d.

NAPHTHALENE.—Crude, whizzed or hot pressed, £5 5s. to £6 5s. per ton; purified crystals, £14 per ton in 2-cwt. bags. LONDON: Fire lighter quality, £5 10s. to £7 per ton. GLASGOW: Fire lighter, crude, £6 to £7 per ton (bags free). MANCHESTER: Refined, £15 10s. per ton f.o.b.

PITCH.—Medium, soft, 34s. to 36s. per ton, f.o.b. MANCHESTER: 32s. f.o.b., East Coast. GLASGOW: f.o.b. GLASGOW: 35s. to 37s. per ton; in bulk for home trade, 35s.

PYRIDINE.—90/140%, 13s. 6d. to 15s. per gal.; 90/160%, 10s. 6d. to 13s. 3d. per gal.; 90/180%, 3s. 3d. to 4s. per gal. f.o.b. GLASGOW: 90% 140, 10s. to 12s. per gal.; 90% 160, 9s. to 10s.; 90% 180, 2s. 6d. to 3s. MANCHESTER: 11s. 6d. to 13s. per gal.

TOLUOL.—90%, 1s. 10d. per gal.; pure, 2s. 2d. GLASGOW: 90%, 120, 1s. 10d. to 2s. 1d. per gal.

XYLOL.—Commercial, 1s. 11d. to 2s. per gal.; pure, 2s. 3d. to 2s. 3½d. GLASGOW: Commercial, 2s. to 2s. 1d. per gal.

Wood Distillation Products

CALCIUM ACETATE.—Brown, £7 10s. to £8 per ton; grey, £9 10s. to £10. MANCHESTER: Brown, £9 10s.; grey, £11 10s.

METHYL ACETONE.—40.50%, £35 to £40 per ton.

WOOD CREOSOTE.—Unrefined, 4d. to 6d. per gal., according to boiling range.

WOOD NAPHTHA, MISCIBLE.—3s. 3d. to 3s. 6d. per gal.; solvent, 3s. 6d. to 3s. 9d. per gal.

WOOD TAR.—£2 to £8 per ton, according to quality.

Intermediates and Dyes

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.

ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.

BENZIDINE, HCl.—2s. 7½d. per lb., 100% as base, in casks.

BENZOIC ACID, 1914 B.P. (ex toluol).—1s. 11d. per lb. d/d buyer's works.

m-CRESOL 98/100%.—1s. 8d. to 1s. 9d. per lb. in ton lots.

o-CRESOL 30/31° C.—6½d. to 7½d. per lb. in 1-ton lots.

p-CRESOL, 34-5° C.—1s. 7d. to 1s. 8d. per lb. in ton lots.

DICHLORANILINE.—2s. 1½d. to 2s. 5½d. per lb.

DIMETHYLANILINE.—Spot, 1s. 7½d. per lb., package extra.

DINITROBENZENE.—8½d. per lb.

DINITROCHLORBENZENE, SOLID.—£79 5s. per ton.

DINITROTOLUENE.—48/50° C., 9½d. per lb.; 66/68° C., 11d.

DIPHENYLAMINE.—Spot, 2s. 2d. per lb., d/d buyer's works.

GAMMA ACID, Spot, 4s. 4½d. per lb. 100% d/d buyer's works.

H ACID.—Spot, 2s. 7d. per lb.; 100% d/d buyer's works.

NAPHTHIONIC ACID.—1s. 10d. per lb.

β-NAPHTHOL.—£97 per ton; flake, £94 8s. per ton.

α-NAPHTHYLAMINE.—Lumps, 1s. 1d. per lb.

β-NAPHTHYLAMINE.—Spot, 3s. per lb.; d/d buyer's works.

NEVILLE AND WINTHER'S ACID.—Spot, 3s. 3½d. per lb. 100%.

o-NITRANILINE.—4s. 3½d. per lb.

m-NITRANILINE.—Spot, 2s. 10d. per lb. d/d buyer's works.

p-NITRANILINE.—Spot, 1s. 10d. to 2s. 3½d. per lb. d/d buyer's works.

NITROBENZENE.—Spot, 4½d. to 5d. per lb., in 90-gal. drums, drums extra. 1-ton lots d/d buyer's works.

NITRONAPHTHALENE.—10½d. per lb.; P.G., 1s. 0½d. per lb.

SODIUM NAPHTHIONATE.—Spot, 1s. 11d. per lb.; 100% d/d buyer's works.

SULPHANILIC ACID.—Spot, 8¾d. per lb. 100%, d/d buyer's works.

o-TOLUIDINE.—11½d. per lb., in 8/10-cwt. drums, drums extra.

p-TOLUIDINE.—2s. per lb., in casks.

m-XYLIDINE ACETATE.—4s. 8d. per lb., 100%.

Company News

William Blythe and Co., chemical manufacturers, announces a final dividend of 7 per cent., making 10 per cent., less tax (same).

Allen and Hanburys, Ltd., wholesale and manufacturing chemists, announces interim of 5 per cent. (same) on ordinary shares in respect of year ending June 30, 1938.

A. and F. Pears, soap manufacturers, controlled by Lever Bros. and Unilever, show profit £80,925 (£77,441); dividend of 15 per cent. on ordinary shares (12½ per cent.); forward, £28,051 (£27,526).

Sadler and Co., chemical manufacturers, announce an interim of £750,000, divided into £350,000 in 5 per cent. cumulative preference 3 per cent., less tax (same), payable April 14, to holders registered March 21.

John Knight, Ltd., in their report for 1937, show profit £239,088 (£227,160); add £141,722 brought in, making £380,810; dividend on 25 per cent. cumulative preferred ordinary £125,000; dividend of 40 per cent. (same) on ordinary £120,000; forward £135,810.

John Dickinson and Co., paper manufacturers, is paying a final dividend of 6 per cent. and a bonus of 4 per cent., making a total total of 14 per cent., less tax, for 1937. For 1936 a final dividend of 6 per cent. and bonus of 2 per cent. brought the year's total to 12 per cent.

Bede Metal and Chemical Co., announce that profit for 1937, after writing of depreciation, and making provision for tax and N.D.C., was £21,185 (£10,243). Dividend of 1s. 3d. per share, or 15⅝ per cent., less tax (6¼ per cent); to reserve £10,000 (£5,000); forward £8,512 (£8,231).

Tunnel Portland Cement Co. is maintaining its dividend for 1937 on the "A" and "B" shares at 25 per cent., less tax, with a final dividend of 15 per cent. The £65,000 "B" ordinary shares issued last August, however, rank for the final dividend, which is thus payable on £300,000 "A" ordinary and £500,000 "B" ordinary. Earlier this month, the authorised "B" ordinary capital was increased to £700,000.

Doulton and Co., makers of acid-proof chemical stoneware, pottery and sanitary equipment, announces a dividend of 7½ per cent. for 1937, the same as in the previous year. Previously nothing had been paid since 1930. In addition, £100,000 standing to capital reserve account is to be capitalised and distributed to ordinary stockholders in the proportion of one new ordinary share of £1 to every £4 of stock held. A further £10,000 standing to the same account is to be divided among ordinary stockholders by way of a cash bonus of 2½ per cent. The present issued capital amounts to stock and £400,000 in ordinary stock. The latter is privately held.

Thos. Firth and John Brown, Ltd., is again increasing its ordinary dividend. The final payment for 1937 is 11½ per cent., making 17½ per cent., tax free, for the year. This compares with 15 per cent., tax free, for 1936, 12½ per cent. for 1935 and 5 per cent. for 1934. Net profits have jumped from £390,534 to £537,682. Gross profits increased by £211,706 to £867,724. Depreciation absorbed £8,000 more at £100,000, and tax and N.D.C. required £175,000, against £120,000, for tax in 1936. General reserve again receives £100,000, and this year a similar amount is placed to stock reserve, leaving the carry-forward £18,432 up at £97,366.

United Glass Bottle Manufacturers, increased their net profit sharply by £109,166, to £254,659, in 1937. They are to pay a final dividend on the ordinary shares of 6 per cent., less tax, making 9½ per cent. for the year, against 8½ per cent. for 1936. The directors also announce a cash bonus of 2½ per cent., less tax, the same as last year. The payments, however, are made on an almost doubled ordinary capital—£1,117,022 as compared with £617,022 in 1936—500,000 new ordinary shares of £1 having been issued in April last. These, as well as the £600,000 new preference shares, were issued to the Distillers Co. and associated companies in discharge of the purchase price for the shares of British Bottles, Ltd.

New Companies Registered

A. V. O. L. Laboratories, Ltd. 338,089.—Private company. Capital, £1,000 in 500 shares of £2 each. To carry on the business of manufacturers of and dealers in pharmaceutical preparations, chemicals, etc. Subscribers: Charles Patey, Inveroak, North Park, Gerrards Cross; Herbert G. Uren. Registered Office: Harp Works, North Circular Road, Cricklewood, N.W.2.

Thurrock Chemical Company, Ltd. 338,083.—Private company. Capital £5,000 in 5,000 shares of £1 each. To carry on the business of manufacturers and importers of chemicals, gases, salts, acids, disinfectants, fertilisers, drugs, oils, colours, glues, gums, pigments, varnishes, dyes, perfumes, soap and toilette requisites, and chemicals and laboratory equipment, etc. Directors: William T. Calderwood, Stobhill Grange, Morpeth; George H. Walton, Morton P. Woodward. Registered Office: Phoenix Buildings, Collingwood Street, Newcastle-on-Tyne.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Receiverships

R. H. ALLEN AND CO., LTD. (331,458). Manufacturing chemists, etc., 251 Dartmouth Road, S.E.26. W. J. Castle, 164-166 Rushey Green, Catford, S.E.6, was appointed receiver and manager on March 16, 1938, under powers contained in instruments dated September 17, 1937.

Voluntary Liquidation

FRASER COLOUR PRODUCTS, LTD., 1 Hyde Vale, Greenwich, London, S.E.10.—The statutory meeting of creditors was held recently, when a statement of affairs was submitted which showed liabilities of £929 10s., whilst after allowing £36 10s. for preferential claims the net assets were £149, or a deficiency, as regarded the creditors, of £780. The issued capital of the company was £6,250, and so far as the shareholders were concerned there was a deficiency of £7,030. The company was formed in February, 1936, with a nominal capital of £10,000 to acquire and exploit a special colour process. For some months the company was occupied by experimental research and were never able to launch on a sales campaign of any magnitude. During the ten months to December, 1936, there was a loss of £1,850, whilst in the following twelve months there was a further loss of £950. After discussion the creditors passed a resolution confirming the voluntary liquidation of the company with Mr. G. H. Fraser, of Payne, Stone, Fraser and Co., C.A., 112 Fore Street, London, E.C., as liquidator.

Petition for Reduction of Capital

SILICA GEL, LTD..—A petition has been presented for the confirmation of the reduction of the capital from £315,500 to £265,500, and is to be heard at the Royal Courts of Justice, Strand, London, on April 4, 1938.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BABBITT PRODUCTS, LTD., London, N.W., soap manufacturers. (M., 2/4/38.) March 19, £700 debentures, part of £5,000 already registered.

CELLULOSE COMPOSITIONS CO., LTD., Trumpington. (M., 2/4/38.) March 18, series of £3,000 (not ex.) debentures, present issue £1,100; general charge. * Nil. January 31, 1938.

DARWINS, LTD., Sheffield, steel manufacturers. (M., 2/4/38.) March 18, supplemental Trust Deed dated March 17, 1938, securing £200,000 debenture stock with premium of 2 per cent. inclusive of £100,000 secured by Trust Deed dated August 18, 1937, present issue £100,000; charged on certain shares, etc., and the specifically mortgaged premises referred to in Trust Deed dated August 18, 1937. * Nil. June 11, 1937.

DUDLEY METAL CO., LTD. (M., 2/4/38.) March 16, £300 debenture, to W. Hartill, Dudley; general charge. * Nil. July 29, 1937.

J. C. VERBINNEN, LTD., London, E.C., glass manufacturers. (M., 2/4/38.) March 17, £3,500 debentures, part of £5,000 already registered.

NORTH BRITISH ALUMINIUM CO., LTD., London, E.C. (M., 2/4/38.) March 7, disposition, supplemental to a Trust Deed dated Sept. 12, 1934; charged on additional garden ground at rear of Glentor, Fort William. *—. April 14, 1937.

Declaration of Solvency Filed

ANGUS WOOD, LTD., Birtley, manufacturers of zinc, oxide, etc. (D.S.F., 2/4/38.) March 17.

Receivers Ceasing to Act

NEW ZEALAND SULPHUR CO., LTD., London, E.C. W. G. Antrobus. March 22.